

MANAGEMENT VIEW

POWER POOLING--PLANS APART--Intended or not, public impressions made by private power interests and by the Administration spokesmen last month tended to sharpen the picture of separation of company and state in the approach to nationwide interconnection of electric power facilities. The effective look-ahead on transmission construction coordinated by EEI (See page 46) was accompanied by obvious intimations of general aloofness from federal programming. Reacting, Interior Secretary Udall expressed hope that the 10-year program of the investor-owned companies would open the way for a cooperative planning effort; but, he failed to mention any progress in this direction by a committee he revealed he had appointed last April to get together with representatives of EEI.

"THE MEANS, A TIME LIMIT" . . . Neighboring electric utilities in the Carolinas and Virginias (Carolina P. & L., Duke Power Co., S. C. Elect. & Gas and Virginia Elect. & Power Co.) in this way referred to their plans to coordinate and pool their power production and transmission facilities (announced coincidentally with the EEI-sponsored presentation on Sept. 11). Observed Vepco Pres. A. H. McDowell: "The basic plan does not include the details, however it does designate the means of arriving at mutually agreeable plans and sets a time limit of Jan. 1, 1963 for this to be accomplished." (Noteworthy, too: mention that the atom got these companies together earlier--in 1956, when they joined to build and develop the first atomic power station in the southeast.)

NORTHWEST'S COORDINATION AGREEMENT, in final draft acceptable to negotiators for the 14 affected parties, was announced last month as ready for "policy decision on signing by responsible officials of each entity." (Generating utilities downstream would pay the U. S. \$1.1-million in the coming year for benefitting from water storage at federal upstream dams; and, similarly, lesser amounts to non-federal storage owners.) BPA Administrator Luce said the agree-

ment sets up "the only fully coordinated area-wide hydro system involving voluntary participation of a variety of owners, with no loss of identity or sacrifice of management control of its system." But, an early balk came from one, Seattle City Light. The municipal's Supt. Paul J. Raver (an ex-BPA chief) said he had always favored such cooperation, but needed more time to study all of the implications of the contract ("including one which practically committed City Light, in principle, to sign a 50-year agreement.") Supt. Raver indicated, too, that he was not sure whether a multi-party agreement, with its complications, was necessary at this time.

WANTED: FPC'S DECISION--Because the Pacific Northwest Power Co.'s only desire is "to see the already year-long proceeding on Snake River dam building completed so that remaining legal steps can be taken and the matter placed in the hands of the Commission for an early decision." As the four-utility group waived further cross-examination of technical witnesses for the Washington Public Power Supply System, PNP's Pres. John J. Burke asserted: "PNP's original engineering conclusions were accurate, and cross-examination by opposing attorneys had not changed our stand that the High Mountain Sheep plan offers greater power and flood control benefits cheaper than the competing Nez Perce plan."

ECONOMIC CLIMATE

EXCELLENT OUTLOOK for the rest of the year and on into 1962 is foreseen by most economists. The total output of goods and services, running in the neighborhood of \$520-billion a year as recovery really got under way, is likely to rise to an annual rate of \$570-billion by the middle of 1962--and optimists anticipate a \$600-billion rate by the end of the year.

DESPITE THE BOOM, little or no inflation danger is foreseen by Administration economic advisers. The President's top economist thinks prospects for holding the price line are excellent, "barring

Electric Utility Barometer

(Source: Edison Electric Institute)



NEWS IN PERSPECTIVE

developments in the military which might touch off scare buying." Conservative business economists take a similar view, holding that more output, not necessarily accompanied by higher prices, will result from improved business.

ECONOMIC CONTROLS will be imposed only as a last resort, but some curbs on growth seem inevitable. The Chairman of the Council of Economic Advisers thinks that a hike of \$10-billion in government spending this year "would definitely require countermeasures." The Administration concedes a \$6-billion deficit for the current fiscal year; it's not hard to find people who should be in the know to go as high as \$10-billion. Sen. Byrd (D., Va.), chairman of the Senate Finance Committee, anticipates a deficit of this size. The sort of "countermeasures" in the Administration's grasp are not direct price or wage controls,

but "a tighter monetary policy and a tighter fiscal policy."

INVENTORY ACCUMULATION PERIOD is in the offing again, notes John D. Wilson, Chase-Manhattan Bank V-P. In remarks for the recent Ebasco client companies conference, he predicted a continuing upturn in the U. S. economy. But, after the inventory accumulation peaks in the second quarter of '62, he forecast, "ultimate slowdown in the rate of such inventory accumulation will tend to brake a further upswing in the second half."

WASHINGTON INFLUENCE

COOPERATIVE PLANNING by industry and government "for the full utilization of the present and future facilities of private industry, consumer-owned utilities and the federal government" was urged by Interior Secretary Udall as the "logical next step" when he learned of

EI's 10-year program of transmission line construction. He hopes for an eventual plan to interconnect and pool facilities of public and private systems. Udall also asserted that "major lines should be operated on a common-carrier basis," but he declined immediate comment in specific terms on the proposed lines.

SOCIALIZATION of the electric industry will follow construction of a nationwide federal transmission grid, says Rep. Ben F. Jensen (R., Iowa). If a grid is built, he adds, public power advocates will set a national rate so low that no investor-owned company can live."

COLORADO RIVER POWER LINES--Of great concern to the Administration, this project, supported by a \$4.2-billion appropriation for construction of seven transmission lines, won House approval (375-31) in Sept. and was sent on to the Senate.

DEFEAT OF HANFORD POWER proposal does not, of course, spell an end to efforts to put AEC in the power business. Despite solidity of House rejection of Hanford A-power, die-hards in the Senate expect to try again next year. Supporters of the Hanford project do not see its defeat as a rejection on public power; they feel that "fuel politics" were the main snag.

FIRST COMMERCIAL LOAN under REA's help-the-customers program goes to Verency Electric Co-op, Velva, N. D. The co-op will relend \$25,000 for five years to Thompson Construction, a member-consumer, which will buy and install electric gravel crushing and washing machines. The loan covers 80 percent of the total cost of new facilities. The firm, in a disaster area, will employ 10 new workers and hopes for new orders from defense and highway contractors in the area.

HIGHEST AVERAGE CONSUMPTION per month of REA power since 1954 has been recorded by the state of Washington, Administrator Norman M. Clapp has informed Sen. Warren G. Magnuson. Clapp adds, perhaps unnecessarily: "This certainly shows that the rural electric

systems in your State are providing a needed and necessary service." Washington consumers used 1,627-kwh in 1960; Utah held second place with an average use of 1,554-kwh. Clapp also asserted that of the almost 1,000 REA borrowers in the nation, only one is behind in its loan payments.

STOCK OPTION DETAILS must be stated by public utility holding companies starting in 1962. After the Securities and Exchange Commission knocked down a staff challenge to stock options, SEC Form U5S was changed to require information concerning options given to officers, directors, and subordinate employees. Middle South Utilities is believed to be the only PUHC now granting options.

FEDERAL POWER GRID to serve midwestern missile bases has been proposed by the Interior Department. Total cost of \$4.7-million is to come from fiscal 1962 and 1963 funds. The transmission system would be a part of the Missouri River Basin Project. Contracts with local co-ops for power have already been made by the Air Force.

DELAWARE COMPACT--a first in federal-states joint development of a river basin --requires Congressional approval of all projects in which federal funds are used. Attempt by Interior Secretary Udall to write in a public preference clause failed. All four states party to the agreement had approved the compact.

ALABAMA POWER CO. has been directed by FPC to show cause why it should not accept and comply with FPC orders concerning hydro projects on the Coosa River. The problem, as FPC sees it, is that Alabama wants to include two developments in a license terminating more than 50 years from the dates they were licensed. FPC also made subject to dismissal Alabama's proposal to build a \$10-million power plant.

CHANGES IN SPOKANE VALLEY reclamation project proposed by the Interior Department would raise cost of facilities of the multi-purpose project to \$7,178,000 with a benefit-cost ratio over 50 years

NEWS IN PERSPECTIVE

of 1.20 to 1. Under the authorized plan, cost was estimated at \$5,100,000, all allocated to irrigation. Under the payout calculation made by Interior, \$1,269,000 would be required from power revenues of Chief Joseph Dam. Changes were needed, according to Interior, because it was decided that municipal water supply should be part of the project, some owners--by deciding not to participate--changed the repayment calculation and improved materials were needed.

IMPACT ON FISHWAYS of filling the reservoir at the new Wanapum hydro project will be examined by FPC on Oct. 30 at a hearing.

POWER RATE REGULATION is now handled by FPC's Bureau of Power, which takes care of the power reports formerly under the Chief Accountant. FPC's objective is to facilitate "program planning and control" by concentrating related items in a single office.

INDUSTRY SIFTINGS

DATA PROCESSING PIONEERS in the electric utility industry are making 1961 "the year" for innovations. EL&P has noted a number of them (most recently, in Oct. 1 issue, Philadelphia Elect.'s automatic generator loading using new computation concepts); and there are others, like: Dayton P. & L. ("first in the utility industry to use magnetic imprinting on customer bills"), Atlantic City Elect.'s transition to magnetic tape for records of material items in its stores accounting operations, Kansas G. & E.'s early work with the "MARC" monitoring results computer. To keep up on fast-changing technology is a growing problem, of course. Among ways to stay abreast: uninitiated engineers went to a special computer workshop last week at the National Electronics Conference; and a newly formed "Users' Association," helping Minneapolis-Honeywell customers compare notes, will meet next in Houston, Texas, later this month.

APPLIANCE SALES RECORDS in first

seven months of '61, according to NEMA figures, show gains only for dishwasher and waste disposers, with electric range sales about even with a year earlier. Rest of year, says one supply spokesman (Kelvinator's H. L. Travis), will see 20-percent gain over last quarter of '60 . . . and sales for the entire year will match last year's. Says another (GE's Harold F. Smiddy, addressing Ebasco's marketing conference): selling opportunities ahead are greater than in the depression-ridden 1930's, whose highly creative selling practices might well be employed in the decade ahead.

N.E.W. PLANNING GUIDES for observance of National Electrical Week next Feb. 11-17 are being mailed to industry leaders and groups this week. Guides will offer samples or illustrations of a number of new items for promoting the theme, "Electricity Powers Progress."

NEMA'S ANNUAL MEETING next month in NYC will pack the Association's business into one day (Nov. 16), topped off by a panoramic view of the industry in action "Eyewitness to the Electrical Industry." (Getting special attention on the NEMA program are 1962 plans and objectives in the "vital area" of public relations; and "the industry's interest in Walsh-Healey Act proceedings.")

PLAYGROUND LIGHTING PROGRAM in New York City is producing "astounding" results in the prevention of vandalism and juvenile delinquency, a report to an IES national technical conference shows. A \$1.2-million crash program to improve exterior lighting on 392 playgrounds in the city has been considered so successful that an additional \$1-million will be spent to extend the program next year. (Lamps used are 400-watt reflector type, color improved by fluorescence.)

HIGHWAY INTERSECTION LIGHTING can reduce driver tension by more than 20-percent, tests on Texas highways have proved by applying medical techniques for the first time to measure driver reactions to lighted and unlighted highway conditions. An assistant research engineer at the Institute of Traffic Engineers reported the tests at the Institute's recent annual meeting.



SHORT-CIRCUIT CHARACTERISTICS OF SPACER-CABLE

By L. F. ROEHMANN, Senior Research Engineer,
Kaiser Aluminum Department of Metallurgical Research, Spokane, Washington

Kaiser Aluminum evaluates mechanical performance of its spacer-cable when subjected to single-phase and three-phase short-circuits.

HOW SPACER-CABLE WILL PERFORM under single-phase and three-phase short-circuit conditions is an important question. Kaiser Aluminum built a special test line to obtain the answer for its own K/W* spacer-cable design shown in Fig. 1.

Generally speaking, short-circuits can impair conductor performance in two ways: thermally and mechanically. It was the mechanical

performance in which we were interested. To steer clear of thermal complications we selected conductors of such size, currents of such magnitude and times of such duration that the parameter which governs thermal performance, $(I/A)^2t$, i.e., the square of the current density times time, remained within safe limits.

As phase conductor, we selected 397.5-mcm aluminum, butyl-neoprene insulated. We restricted time to 0.8 second, a realistic clearance time for distribution circuits. We could then apply root-mean-square currents up to 13,000 amps without heating the conductor more than hand warm. These rms-currents were associated with peak inrush currents which were, roughly, twice as high. Exposed to them, the spacers suffered considerable mechanical damage.

How high are the short-circuit forces associated with such currents? If two parallel conductors, of length L and distance D , carry the same current flowing in opposite directions, a repulsive force develops. It can be calculated from the equation

$$F = 4.50 \frac{L}{D} I^2 \times 10^{-8} \text{ lbs.}$$

* Registered trademark of Kaiser Aluminum and Chemical Corp.

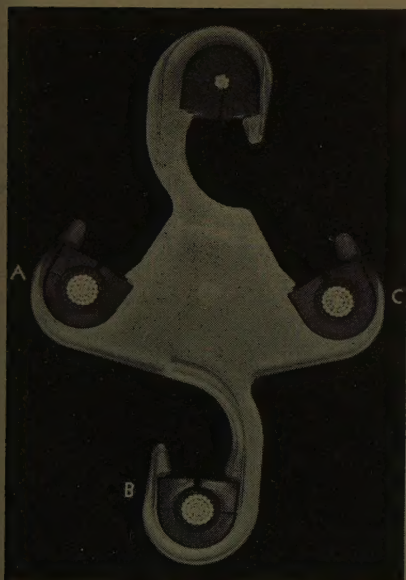


Fig. 1—(left) K/W spacer-cable design tested for short-circuit characteristics.

Fig. 2—(below) Test line to check spacer-cable performance under short-circuit conditions. A: Dead-End Structure B: Supporting Structure

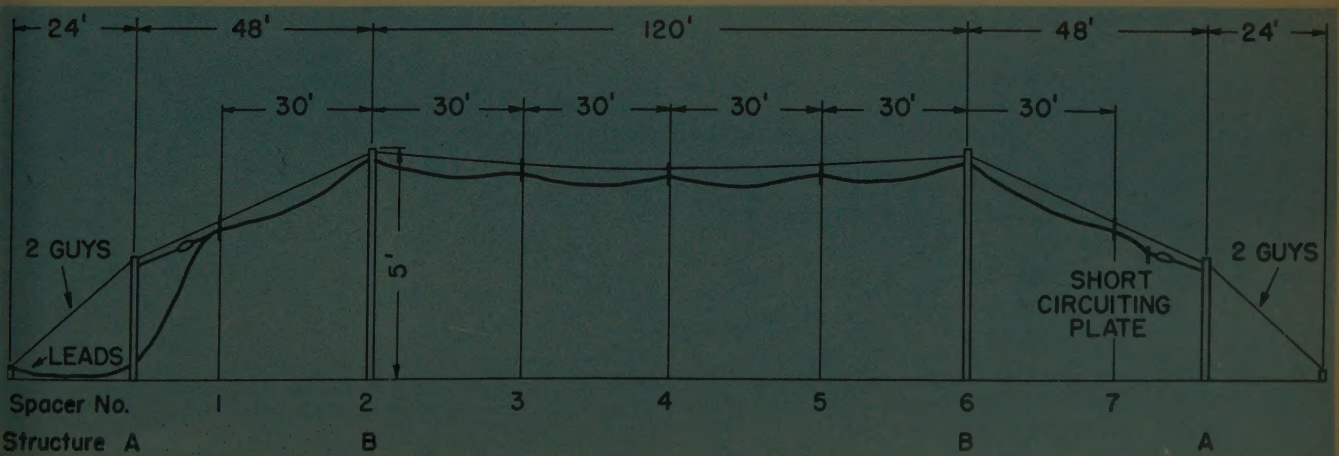


TABLE I

THREE-PHASE SHORT-CIRCUIT TESTS

Neutral/Messenger Always Sagged for 70F or to 5 Inches,
Without Phase Conductors

Reactor Turns	Average Symmetric Current, amps rms	Peak Asymmetric Current, amps peak	Conductor Lifts	Grommets Thrown	Spacer Breaks	Observations
Spacers on 30-ft Centers						
Phase Conductors 4 Inches of Sag (Neutral/Messenger 23 1/2" Sag, When Loaded with the Three Phase Conductors)						
17	5,000	11,600	—	—	—	Just some movement—conductors clashing
10	7,400	15,000	—	—	—	More action, no distress
7	9,100	17,500	—	—	—	Fairly violent shudder
5	10,700	23,000	—	—	—	Quite violent shudder
3	12,000	23,400	—	—	—	Still no distress. Conductors hand-warm
2	12,900	27,800	—	—	—	About the same
1	13,300	29,000	7	7	3	Action!
1	13,200	27,200	5	5	3	Repetition
2	12,700	26,100	2	2	2	Repetition—2 turns
3	11,800	24,200	—	—	—	Repetition—3 turns—no distress
Phase Conductors 2 Inches of Sag (Neutral/Messenger 20 1/2" Sag)						
5	10,600	22,600	—	—	—	No distress—strong shudder
3	11,900	23,800	—	—	—	Same
2	12,600	28,300	4	6	2	Action
1	12,800	28,400	8	7	4	Action
Phase Conductors 1 inch of Sag (Neutral/Messenger 18" Sag)						
3	11,800	23,600	—	—	—	No distress—shudder
2	12,600	25,500	—	—	—	No distress—shudder violent
1	12,500	25,500	9	9	6	Worst action of all
Phase Conductors 6 Inches of Sag (Neutral/Messenger 24 1/2" Sag)						
5	10,100	20,000	—	—	—	Considerable motion after the shot
4	10,500	23,200	—	—	—	Considerable motion after the shot
3	11,700	25,800	—	—	—	No distress
3	11,800	23,900	—	—	—	Repetition—no distress
2	12,000	25,800	5	4	3	Action
Spacers on 20-ft Centers						
Phase Conductors 2 Inches of Sag (Neutral/Messenger 24" Sag)						
5	10,400	20,800	—	—	—	No distress
4	11,200	24,700	—	—	—	No distress
3	11,900	22,800	—	—	—	No distress
2	12,700	25,200	—	—	—	No distress
1	13,500	26,400	—	—	—	No distress

For a conductor-to-conductor spacing of six inches or 1/2 foot as in K/W spacers, the force is

$F = 9 I^2 \times 10^{-8}$ lbs per running foot.

For a peak current of 10,000 amps and for the standard spacing of 30 feet between spacers, the repulsive force is $9 \times 30 = 270$ lbs; for 20,000 amps peak, the force is four times as much or 1080 lbs; and for 25,000 amps peak, it is 1690 lbs. Forces of this magnitude will develop various failure patterns depending on where they act.

When, in single-phase faults, phases A and C are faulted, the conductors will first "shudder"; then, as the current reaches extremes, the spacers may break. When phases conductors A-B (or C-B), Fig. 1, are faulted, conductor A (or C) will be lifted out of its cradle in the free span. Phase conductor B is pressed down, hence it cannot be lifted out. If a spacer is attached to a pole where there is an appreciable downward component resulting from conductor tension, the added downward force imposed by an A-B or C-B fault may tear off the cradle of conductor B.

In three-phase short-circuits there will be no lifting per se. However, in severe faults, the conductors may be lifted out and then thrown free at some spacers, con-

Fig. 3—Single-phase lifting tests—number of grommets thrown and number of conductor lifts vs. rms-current.

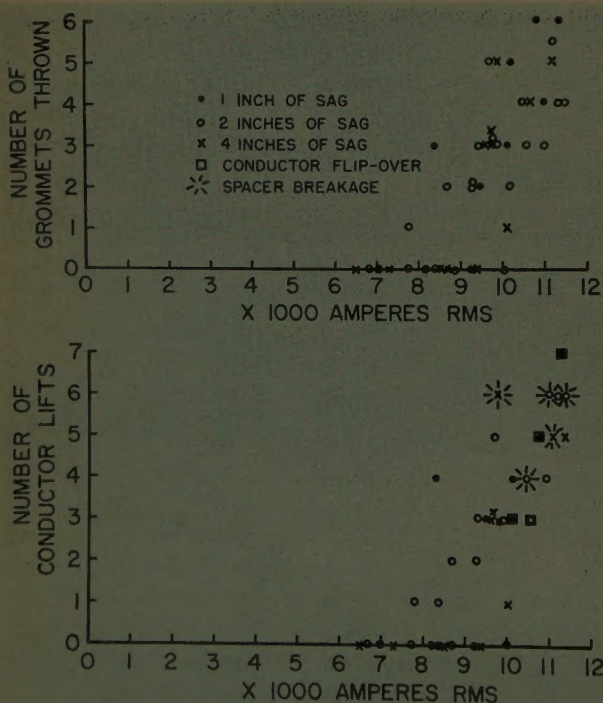
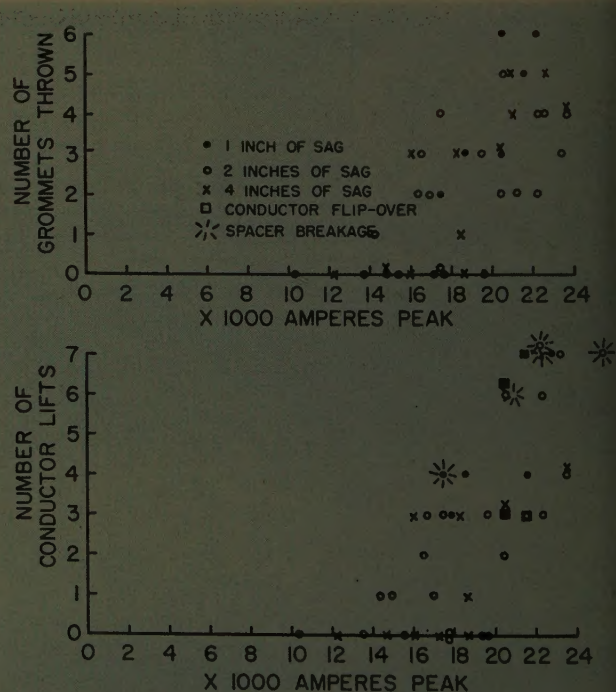


Fig. 4—Single-phase lifting tests—number of grommets thrown and number of conductor lifts vs. peak current.



current with breaks of other spacers.

This was our reasoning. To substantiate it, and to obtain numerical data, we built the test line sketched in Fig. 2. The main span, of 120 feet, contained five spacers, two at the supports and three in the free length. The 48-ft back-up spans contained one additional spacer each. This line was energized from a 7.5-kva transformer whose secondary current could be varied between 8,000 and 15,000 amps rms. We were able to reproduce the rms-currents accurately but had no control over the maximum or peak-inrush currents. However, in every test we recorded rms and peak currents on oscillograms.

Test Results

Single-Phase Breaking Tests.

When phases A-C were faulted, the conductors shuddered. With increasing current, they shuddered violently but in only four cases, out of 30 tests, did the spacers break. Currents in this test series ranged from 1,500 to 12,500 amps rms and from 8,900 to 24,800 amps peak. In some cases, breakage occurred in the second and third repeat test; in other cases, even a fourth repeat test did not cause spacer breakage.

Single-Phase Lifting Tests.

(Short-circuits between phases A-C or B-C.) These tests gave con-

siderably more information. Fig. 3 shows the number of grommets thrown and number of conductor lifts vs. rms-current. Fig. 4 gives the same information vs. peak current. Up to 8000 amps rms and 14,000 amps peak, nothing happened (except that the top conductor lifted itself up against gravity, forming a negative sag). With increasing current, grommet throwing and conductor lifting increased, and eventually, some spacers broke. Variation of sag had a minor influence. As expected, the spacers broke at the supports where the cradle of phase B was torn off. This suggests moving spacers away from the supports, out into the span, 15 feet on either side of the support.

We made no single-phase tests between phase conductors and neutral-messenger. Such tests would not have given new insights but would have caused thermal complications because of the lower conductance of the neutral-messenger, compared to the phase conductors.

Three-Phase Tests. The results of the three-phase tests are tabulated in Table I. The independent variable was the number of reactor turns which governed the symmetric rms-current. In the first group of tests, we decreased reactor turns to three, two and one, repeated the test with one turn and increased turn numbers again to

two and three. The reproducibility of the data is gratifying. Up to 12,000 amps rms and 26,000 amps peak, there was no conductor lifting or spacer breakage. The highly-tensioned conductor (one inch of sag) showed no distress up to (or, rather, down to) two reactor turns. However, there was violent action with one turn, i.e., high current. This was in line with its performance in the single-phase lifting tests (dots in Figs. 3 and 4).

With spacers on 20-ft centers, there was no distress up to the maximum power available. This stands to reason: the repulsive force between conductors was unchanged but the restraining force was increased 50 percent.

During some of the tests, we took still photos and normal- and slow-motion pictures. Analysis of one of the slow-motion film strips, taken during a severe three-phase fault, brought out an interesting fact. The mid-span spacer, Fig. 5, did not break until 0.35 second or 21 cycles after current application. Conductor C first bulged out but only moderately so, then came back. It again bulged out to an almost grotesque angle, then the cradle tore off and the conductor flew outward. Obviously, the instant of energization was such that the full force did not develop initially. Tests made with only a few cycles may not always tell the full story.

Summary Comments

Our findings can be summarized as follows:

(a) In single-phase short-circuits, K/W spacer-cable will withstand 8000 amps rms and 14,000 amps peak with the conductors remaining in the spacers. Above these values, the conductors may be lifted out of the spacers, without damage to spacers or conductors.

(b) In single-phase short-circuits, K/W spacer-cable will withstand 9000 amps rms and 17,000 amps peak without spacer breakage.

(c) In three-phase short-circuits, K/W spacer-cable will withstand 12,000 amps rms and 26,000 amps peak without conductor lifting or spacer breakage.

All these figures are valid for spacers on 30-ft centers and for a conductor tension corresponding to temperature as low as -20°F .

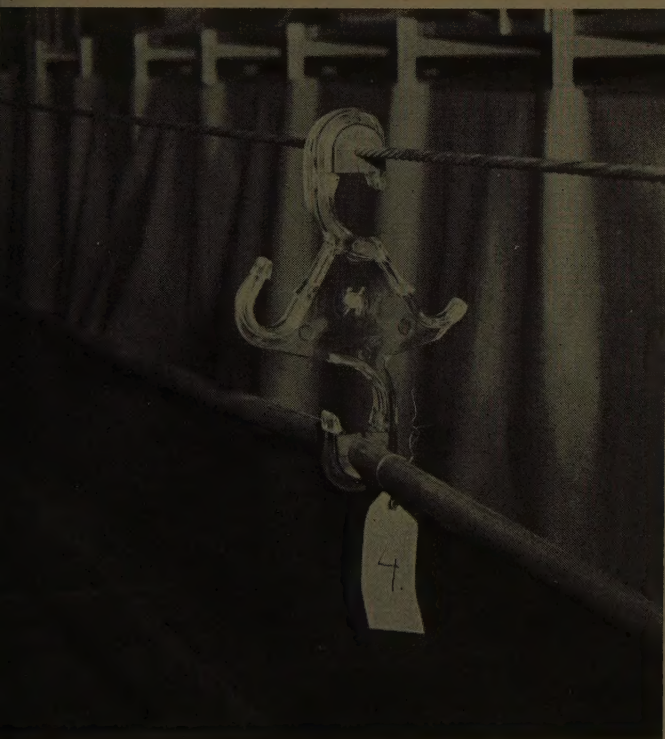


Fig. 5 — Mid-span spacer No. 4 after test for three-phase fault at 13,000 amps rms, 27,300 amps peak. Phase A conductor lifted out; cradle of phase C broken off. Grommets and broken parts thrown clear.

HOLLOW ALUMINUM CONDUCTOR

Proves Reliable

ON 230-KV WOOD-POLE LINE

SOME TIME AGO when the New England Electric System was confronted with the need for a pair of 230-kv wood-pole circuits to connect its then-being-built 190-mw S.C. Moore Station with the system's twin 230-kv steel-tower lines at the Comerford Station, 6.6 miles away, certain considerations favored use of expanded-strand conductors. However, dissatisfaction with existing paper or hemp expanded conductors led us to a study of other types and, finally, development of a new hollow aluminum conductor. Now, after five years of operation with this conductor, we feel that its suitability for use as an expanded strand has been proven.

Both the Moore and Comerford Stations are hydro-electric plants located on the Connecticut River in northern New Hampshire. The former station develops a total capacity of 190,000 kilowatts which is transmitted over the twin wood-structure lines to the latter plant where it connects to the two 125-mile-long steel-tower lines, each carrying 795-mcm ACSR conductors on 23.5-ft phase spacing.

By ANDREW E. HILL, Transmission Engineer,
New England Electric System

Relatively low conductivity requirements coupled with need for stringent corona-loss and radio-influence characteristics prompt development of new expanded strand conductor.

Design Considerations

To match performance of the conductors on the steel-tower lines, from the standpoints of corona loss and radio and TV influence, it was necessary to specify somewhat larger conductors for the wood-pole lines in view of the 16-ft, 8-in. phase spacing instead of 23-ft, 6-in. At the same time, conductivity requirements were low in that maximum current per circuit would be only 250 amp, and annual loss factor would be relatively small. These conditions pointed to application of some type of expanded-strand conductor.

After investigation, the most

promising seemed to be a conductor composed of EC-H19-grade aluminum wires wrapped around a hollow-core "BX" armor. The only producer willing to undertake designing and making the strand, Kaiser Aluminum and Chemical Corporation, sent its engineers to discuss the problem with us. The final result was a conductor having a cross-section of 554,131 circular mils, with outside diameter of 1.12 in. (slightly larger than the 795-mcm ACSR). Ultimate strength is about 11,000 lb and weight is 0.610 lb/ft.

The conductor is composed of an aluminum flexible tubing (similar to the armor of "BX" cable) made of 0.025-in. by 0.375-in. 3003 (3S) H-14 aluminum strip and having an outside diameter of 0.710 in. Over this tubing is stranded a layer of 24 wires, 0.1013-in. in diameter, and a second layer of 30 wires of the same size.

Experimentation

Having worked out production techniques, Kaiser agreed to furnish 1000 ft of the conductor for an experimental span of about 850 ft across a ravine on the line's location near Comerford station. The conductor was installed in January, 1955 and no difficulty was experienced due to construction of strands. It was strung to a sag of 45 ft, on 1225-lb tension at 11F with a two to three mile per hour wind.

Initially, sags were checked daily then at longer intervals until September 1955. After initial stretch there appeared to be only standard elongation due to creep. Temperature during the period from January to March 2, 1955 varied from -9 to +48F.

On March 2, 1955, a reel with cable weighing 1051 lb was suspended overnight from the low point of the span (at the approximate center) to bring tension up to

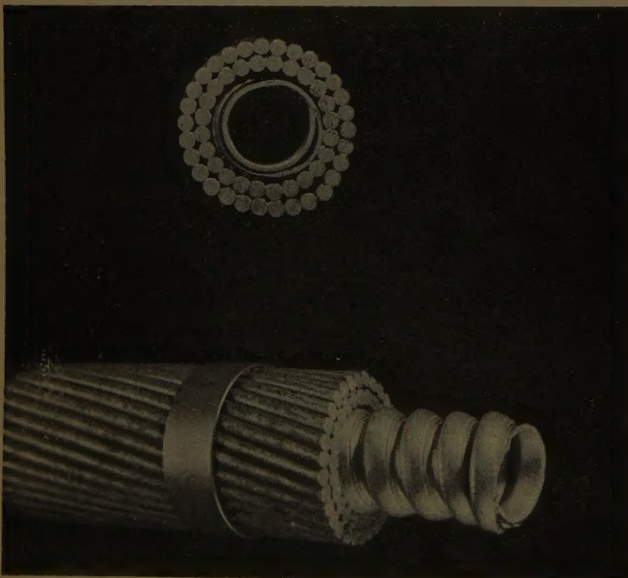


Fig. 2—Expanded strand conductor consists of aluminum "BX"-type flexible tubing with concentric layers of 0.1013-in. diameter aluminum wires.



Fig. 3—Self-contained angle strain structures are employed where guying is impractical due to space limitations on the R/W.

about 5000 lb, well over the design tension based on $\frac{1}{2}$ -in. radial ice, eight pfs wind load at zero F. Conductor returned to sag when cable reel was removed. Galloping was not observed on the test span nor as it been observed on the line itself. Intermittent dancing has been noted occasionally, but it has been rather rare and in the area of about 1 in. in amplitude.

There was doubt about the ability of the conductor to withstand rifle and shotgun fire in the event that frustrated hunters used the conductor for a target. Two tests were made to check this feature of the strand. The first consisted of rifle fire from a .300 caliber Savage with high-speed ammunition, and a 45.70 caliber Winchester using leadnosed bullets at a distance of 30 ft against tensioned (3500-lb in one case; others not known) 8- to 12-ft lengths of the strand. The second test was made by firing the Savage rifle and a shotgun, using slugs, at various points along the test span, from the center to the clamp. The results of both tests were practically identical, indicating that it makes little difference whether the conductor is hit in the span or near the clamp. The second series of tests showed that it took a mini-

mum of four well placed rifle shots or four well placed shotgun slugs to sever the strand.

All parties witnessing the tests agreed that this conductor has the ability to withstand a considerable amount of abuse. There is very little tendency toward wire spin when wires are cut in the span. Also, lacking a steel core which would cause bullet expansion with

greatly increased rupturing of wires, several samples showed a very small bullet hole on the entrance side with surprisingly few cut strands on the exit side. It was interesting to note that center shots on the strand severed the "BX" core completely without collapsing the strand. Incidentally, we did not have to import sharpshooters, they were members of our field crews, who made dead center and graze shots upon request.

In-service Characteristics

Radio and TV influence characteristics of the stranded hollow conductor on 16 ft-8 in. horizontal spacing have been checked instrumentally and by five years of operation. Except for tightening some loose hardware, there has been satisfactory operation of the line in these respects.

As for installation, 14-in. diameter aluminum sheaves and standard Kellem grips, without filler rods in the core of the hollow strand, were used for stringing. There was no tendency to "squirrel cage." Rocks and boulders were covered with wood to protect the conductors during the pulling operation in the same manner which was used for any other aluminum strand at that time. Design span is 400 ft at which the conductor was initially sagged to 8.8-ft sag and 1390-lb tension at 60 F, which will

(Continued on page 53)

Fig. 1—Structures used on the twin wood-pole lines consist of two vertical poles and 45-ft crossarm reinforced with a 30-ft pole. Aluminum pipe outrigger provides air gap to maintain wood impulse insulation value.



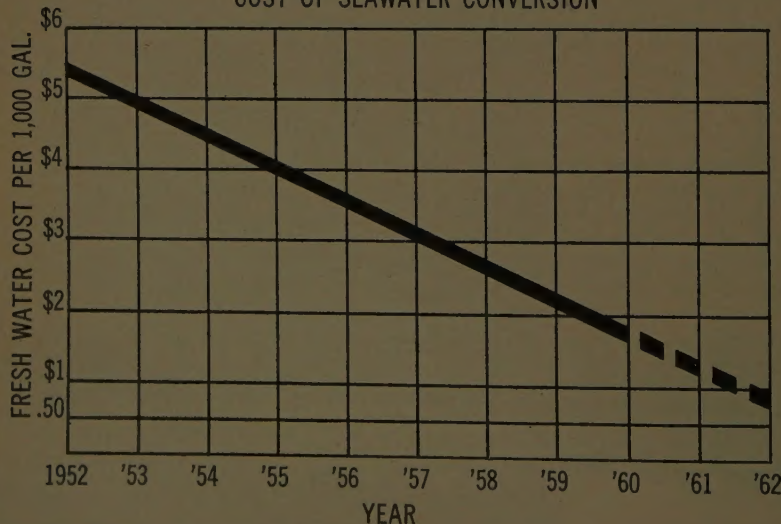
UTILITIES HAVE BIG STAKE IN SALT WATER CONVERSION

The power industry stands to benefit materially from any developments that make the conversion of brackish or sea waters an economically attractive possibility in their areas.

By G. E. SONDERMAN, Vice President, Fluor-Singmaster & Breyer, Inc., New York, N. Y.

Editor's Note: This is the essential text of a paper presented at the 1961 American Power Conference.

COST OF SEAWATER CONVERSION



WE STAND today on the threshold of a new industry—the salt water conversion business. As in the early days of the electric power industry, prophets are predicting a rosy future. You read such phrases as “making the desert bloom,” “pipes carrying converted sea water will crisscross the continents” and, more recently, “sea water conversion will be of greater benefit to mankind than the conquest of space.” As in the early days of Thomas A. Edison, there are those who say “fine, but it costs too much.”

The interest of the power industry in this rapidly developing technology of salt water conversion must of course come to the final analysis: how will it profit the industry? For those utilities serving areas of water shortages, the solution of this problem will yield both load growth and territory growth. There are also interesting possibilities in combining steam-electric plants with water-distillation plants. Before discussing them further it seems in order, first, to look at the current status of sea water conversion and the remarkable progress made in the last 5 years.

Progress In Sea Water Conversion

In 1955 three projects were undertaken in this field, the 144,000 gal per day distillation unit at Morro Bay Station of Pacific Gas & Electric, the 2,700,000-gal per day distillation plant for the Island of Aruba, and the 2,400,000-gal per day installation at Kuwait, Arabia. Cost of production at Morro Bay has been cited at over \$2.50 per thousand gal, and at the Aruba Plant costs were indicated at \$1.10 per thousand gal. The Kuwait installation was based on the availability of fuel at extremely low cost so that no comparable production cost figures are meaningful.

Three years later, in 1958, the author¹ suggested that a plant could be built to produce water from the sea at \$1.00 per 1000 gal, thus practically cutting the cost in half. The major demonstration plants, sponsored by the Office of Saline Waters of the U. S. Department of the Interior, will soon start operating. Their performance has been announced as aiming at a production cost of \$1.00 or better per 1000 gal.

Now in 1961 it is significant to note that all developers of the various sea-water conversion processes work in terms of \$0.50-water instead of \$1.00-water. This cuts the cost in half one more time.

It may take three years or more to achieve \$0.50-water in a working plant as it did for the \$1.00-water, but the significance of the trend is unmistakable. The process chosen to achieve the result does not matter.

There are four freezing processes at various stages of development that claim costs of about \$0.40 per 1000 gal. The recently announced distillate process is expected by its developers to produce water at lower costs than the freezing processes. The distillation process has been estimated in a report to the Office of Saline Water as capable of producing at \$0.42 per 1000 gal in a big plant of 50,000,000 gal per day and at even lower costs for larger plants.

New Designs More Efficient

The evaporating equipment bought in 1956 for Aruba cost \$1.56 per daily gal of capacity at the factory. The evaporating equipment bought in 1960 for Kuwait cost \$0.71 per daily gal of capacity and includes installation! Performance of the latter unit was even better than the first, i.e., an output of six lbs of fresh water per lb of steam versus a ratio of only five to one at Aruba. Yet today modern designs are based on gained output ratios of 12 to 1, or better, when warranted by the high cost of fuel.

Present Conversion Status

Where does the sea water conversion business stand today? Even at \$0.50 per 1000 gal production cost, this is not attractive for municipal water supplies whose costs for obtaining natural waters are frequently only \$0.10-\$0.20 per 1000 gal. Keep in mind that distribution costs average \$0.20-\$0.30 per 1000 gal and must be added to the water costs.

So, in these United States, even the tremendous improvement in the economics of sea water conversion has only brought it to the brink of finding real applications. Some such exist today, namely, those semi-arid areas that must go a long way for natural water sup-

plies, such as Key West, Florida, and areas in Southern California and New Mexico. Others will appear tomorrow as the cost of converting sea water is further lowered by improved technology while the costs of new fresh water supplies are constantly increasing due to the higher costs of land, of construction and of longer transport.

Elsewhere in the world the economics of sea water conversion become more involved. An oil-rich country such as in the Middle East or North Africa may have fuel available so cheaply that much lower costs of sea water distillation are possible. Also it may be to the national interest to devote their financial resources to the capitalization of water conversion plants so they are concerned with operating costs only. In these countries, the costs of labor for construction and operation are much lower than in the U. S. and a plant constructed with a maximum of locally-fabricated equipment and local labor would contribute to the nation's employment so as to strongly influence the economic factors.

Future Prospects In Conversion

The future is bright with promise. Despite the great advances in the distillation processes (which today are still the only proven processes and account for practically all of the present 20-million gal per day production), the following are at least four directions where further improvements may be made:

1. Increase the operating range of the process cycle by starting at higher initial temperatures than the present common limit of 200 F. This will be accomplished by advances in scale-prevention techniques.
2. Improve heat transfer from factors of 600-800 to factors of 2000 or better. This means dynamic surfaces instead of static such as indicated in the principles employed by Hickman, Bromley and General Electric.
3. Combination of distillation processes such as using vapor compression for the denser vapors above atmospheric pressure and flash distillation at the lower end of the cycle.

This has been done on a small scale by Maxim, but as better vapor compression systems and equipment are developed, this combination may be much more fruitful.

4. The development of low-cost heat sources, such as: Spent nuclear fuels, gas turbine exhausts, or any form of waste heat such as incinerators.

Processes other than distillation may have similar potentials for improvements. These processes are still in the stage of being brought to commercial reality and much is yet to be learned.

Irrespective of what process or processes come to the forefront, salt water conversion is rapidly reaching an economy where it will be used more-and-more as a prime or supplementary water supply.

Application To Power Industry

At this point, one may conclude the salt water conversion technology promises great future benefits to mankind. Yet what does this have to do with the power industry?

Actually, there are two aspects where the power industry is involved: One is the direct application of techniques for purifying unsuitable waters to make them usable for boiler feed for steam-electric stations. The other is the much broader implication wherein the power industry can benefit from the development of a sister industry and, in some cases, may profitably participate in this new field.

The direct application for producing make-up water to a steam plant already has established a considerable background. Pacific Gas & Electric's use of sea water evaporators at Morro Bay was intended to demonstrate that a major steam-electric station could be located where sea water was available for condensing needs irrespective of the availability for suitable make-up water. Now that efficient scale-free operation of sea-water evaporators is an accomplished fact, it makes possible the economic selection of power-plant sites which might otherwise be rejected.

Another direct application has received considerable recent impetus. The multistage flash evaporators developed by the sea-water-conversion industry can be put in



Above, Philadelphia Electric Co. multistage flash evaporator built by Westinghouse for making high-purity condensate for non-base loaded power plant.

Below, salt water becomes drinking water in these huge evaporators which are located on the Caribbean at Aruba in the Netherlands Antilles. Singmaster & Breyer were the consulting engineers and construction managers for the plant—completed early in 1959.



the lowest stage of steam plant regenerative cycles at some thermal gain. When supplied with raw water, such as from a municipal supply, the purity of the make-up supplied by such evaporators is satisfactory for even high-pressure boilers without further demineralization. Of course, when supplied with full-strength sea water, purity of much less than one part per million cannot be expected. A paper presented at the 1960 American Power Conference covers this subject in considerable detail.

The Broader Implications

Now, as to the broader interests which the power industry may have in salt water conversion, three aspects should be considered:

- a. Load building
- b. Growth of the territory
- c. Participation in the water industry.

Load Building

There are many communities now served with municipal water that leave something to be desired. They may be high in suspended matter or hardness. This requires the consumers to buy or rent their own filters or softeners and accept this expense as a necessary part of their water costs.

It seems reasonable to believe, therefore, that customers in other areas, where wells are turning salty or where the only additional supplies are saline waters, would readily buy water-purifying units. Since the only small units under development today are electrically operated, these are potential load builders for the electric utility industry.

One type of desalter for moderately-brackish water is the electric membrane unit. A unit for the home has been developed and is now in the first test-marketing stage. Several hundred of these have been sold in Texas to purify brackish waters containing 160 ppm of saline solids. Such devices could be modified for communities where the waters are of greater or lesser salinity. It is estimated that electricity consumed will be 2 kwh for 300 gal of product water, which may be considered an average daily consumption for a family.

In the next larger size unit, such as for motels and hotels, there are already numerous examples of electric

electrodialysis desalting units installed over the last few years. In the community size, the City of Coalinga, California, has installed a 28,000 gal per day plant.

While the electrodialysis or membrane-type purifiers are gaining wider acceptance, several developments are working on compact vapor-compression stills. These also need electricity to drive their compressors, pumps and, in some designs, the rotating heat-transfer surface. One design will produce 500 gal per day with a consumption of 30 kwh, and this ratio is constant for any water that the machine will evaporate. This type of equipment can handle up to full-strength sea water and produce a fresh water very low in solids.

So, whether sea water is to be made potable in a vapor-compression still, or saline water purified by electrodialysis, such devices in the smaller sizes will be users of electric power.

Growth Of The Territory

Much is being published daily about the growing scarcity of water in many parts of the country with dire predictions about the future. At the least, the growth of population and industry in such areas will be sharply limited by lack of good water. At the worst, people will have to move to greener pastures.

This must then be of concern to the electric utilities serving those areas. Therefore, it would not be unreasonable for the utilities to aid in the development and sale of electric appliances that would produce good water from bad—not only as a need for builders but also as a necessity for growth in the number of customers.

On a larger scale, there are semi-arid areas with wonderful climate that would be quickly populated if water was made available. California, Arizona and New Mexico have areas that could develop first as resorts, then for retirement people and eventually for people who just like to live and work in warm climates. Developing these areas could mean a sizeable load potential for the electric utilities serving the territories involved.

So it would seem that the power industry stands to benefit materially from any developments that make the conversion of brackish or

sea waters an economically attractive possibility in their areas. Of course, this industry can simply await developments of better equipment for such conversion by outsiders, but some of the more farsighted utilities in saline-water areas are already working with salt-water evaporators in their steam plants. This helps the utility gain a better knowledge of late developments and also encourages manufacturers to offer improved ideas.

Utility Participation In Conversion

So far this discussion has centered about the broad aims of territory and load growth, and the idea of the power industry maintaining a keen interest and perhaps helping a bit in the development of the water-conversion business. Such broad ideas are not too hard to accept, but the premise that the power industry should also produce water by conversion plants will cause many utility men to shudder. Yet, it is this very situation that has some factors worthy of consideration.

For brackish water, it seems that the electrodialysis process has established its position with no real close competitor. Plants in the multimillion gal a day size are already being built. They require about 7.5 kwh of electric energy per 1000 gal of product, so a 5-million gal per day plant represents a load of approximately 1500 kw for the utility.

For sea water conversion, should the freezing or hydrate processes become the most economical producers of fresh water, they need energy for pumps and compressors. Again the energy requirements for a 5-million gal per day plant is estimated at 30 kwh per 1000 gal, or a load of 6250 kw.

But all this leads to the real big plant with a capacity of 10-million or 100-million gal per day. In these sizes, present indications are that distillation will be king. Then, the idea of combining a steam-power plant with a steam-distillation plant becomes logical.

This is not new—it has been done. The Aruba water plant has a capability of 12,500 kw developed from 850 psi steam passing through a noncondensing turbine. The exhaust at 20 psig and 259 deg F is

supplied to the evaporators producing 2.7-million gal of pure water from sea water. This ratio of generating capacity to water converted is roughly 5000 kw per million gal.

This ratio can be varied, for instance, a more efficient evaporator yielding 10 lbs of product instead of 5 will double the water output with the same quantity of by-product power. It does not work so well the other way. To get more power per million gallons of water produced would require either a less efficient evaporator or better steam expansion in the turbine, or both. This can be done to some extent but the economics would soon favor generating the additional power needs by normal condensing steam plants.

Of course, the thermodynamic advantage of such a combined cycle is basic. When the best steam-electric stations only convert 40 percent of the energy in the fuel to electric energy, it is so enticing to sell the heat content of the exhaust steam from a steam-electric generating unit and get a utilization of perhaps 65 per cent of the heat input.

Adverse Effects Eliminated

Going back to the early days of the steam-electric plants, exhaust steam was sold to industry in many cases. But today there are relatively few such interconnections with the exceptions of some very large and special cases. The thermodynamics lost its advantages when stacked against the practical realities. Two of these disadvantages are: One, the lack of uniformity of the customers' steam load and, two, the adverse effect on utility operations by sudden variations in the industry's plant.

These objections would not apply to the steam power-distillation plant, herein proposed. Water production would be constant as it is a storable produce. Where operated by the power-plant personnel, there is no outside entanglement. The reliability of the evaporators is high and outages are not likely to be sudden.

This idea envisages that the power company would produce converted water at its steam plant on a basis of supplying a constant quantity of water to the water company's pipe line across the fence.

The steam plant would then produce a corresponding fixed quantity of electric power as a base load and at a cost lower than any power produced by the condensing-steam plant.

To try some figures, assume a condensing-steam plant has a net station heat rate of 9500 Btu per kwh. With back-pressure turbines, not charged with the condenser loss, one could easily have a net station heat rate of 4500 Btu. So, splitting the savings, a charge of 7000 Btu per kwh would be assigned to the electric power production.

This is considerably better than the present base-load generation and will most likely remain equal or below future base-load efficiency that may be developed within the life of the present installation. Thereby, the power company benefits by producing a low-cost block of power and the water plant benefits by paying less for its steam—approximately 75 percent of what it would have to pay for steam from low-pressure boilers.

While all this again looks pretty good thermodynamically, one practical objection has been raised. It is the question of loss of capacity when the steam-electric cycle exhausts at atmosphere or above. While the energy that could have been created by expanding the steam to full vacuum is not lost, in fact it is sold for a better price to the distillation plant, there is considerable loss in generating capacity. That means the high-pressure boilers and the high-pressure turbines and all the auxiliaries in the high-pressure end either produce less kw or must be made larger at extra cost.

A recent study³ of a hypothetical combined steam-electric and water-distillation plant indicates that the capacity loss does not result in high capital charges. The proposed plant would be as follows: Water capacity-10-million gal per day, water efficiency-7 lbs of distillate per lb of steam, required steam flow-500,000 lbs per hr and steam pressure to evaporator-10 psig.

For a single-expansion steam turbine exhausting at 10 psig, assuming a reasonably high initial temperature of 1050 F, would require a turbine throttle pressure of 1800

psi. This selection gives a good combination of high by-product power capacity without the higher capital charges incident to more extreme pressures and temperatures. The steam-electric plant will then have the following characteristics: Boiler—1800 psi at 1050 F, 500,000 lbs per hr; turbine—1800 psi with 10 psi exhaust; water rate 10 lbs per hr; gross generation per hr—49,600 kwh and net generating capacity, deducting auxiliaries for both steam and water plants—45,200 kw.

The total heat input for both the above water and power plants is 742-million Btu per hr. Charging the net generation with 7000 Btu per kwh as previously suggested, this amounts to 316,400 Btu per hr. The water production is then charged with the difference, or 426-million Btu per hr.

On the basis of independent production of power and water, assuming power to be generated in a top-efficiency plant of 8000 Btu per kwh for the same 45,200 kw of capacity, there is required a heat input of 361.6-million Btu per hr. The distillation of 10-million gal of water per day would require a heat input of 541-million Btu per hr or a total fuel requirement of 902-million Btu per hr. Table I shows this comparison more clearly.

TABLE I SEPARATE PLANTS VS COMBINED PLANTS (Energy requirements in million Btu per hour)			
	10,000,000 G.P.D.	45,200 kw	
	Water Product	Electric Product	Total
Separate Plants	541	361	902
Combined Plants	426	316	742
Savings	115	45	160
Percent Saving	21	12.5	18

Capacity Loss

The same boiler output of 500,000 lbs per hr, when put through the most efficient regenerative, reheat cycle through full-expansion turbines condensing at 28.5-in. Hg vacuum, would produce a gross 73,000 kw. Here then is the capacity loss of considerable magnitude but of no economic significance because the capital costs are not penalized.

An estimate based on current list prices shows that for the conditions of this example, the total capital cost was practically the same for the 1800-lb pressure non-condensing power plant as for an efficiently designed 1800-lb condensing station of equal capacity.

While the boiler and turbine are larger and more costly in the non-condensing plant, these factors are offset by the savings. The entire condensing equipment is omitted and the evaporators are, in effect, the steam condensers.

Since there is no condenser loss there is no point in a regenerative reheat cycle. Feed water heating would be held to a minimum and the boiler would be equipped with an economizer. The water plant, however, does not have to install boilers so there is actually a saving in total capital charges.

This is not all. The combined electric-and-water operation would use the same supervisory staff, the same maintenance crew and very little more operating labor than the steam plant alone.

The Path Ahead

With some parts of this country already short of water and with the tremendous rise in water demand currently predicted, the electric power industry will become increasingly aware that water, or the lack of it, affects their customers, their territory and their profits.

Water is not just a special problem for some few semi-arid parts of the United States, as it has been predicted that about one-third of the country will need more water supplies in a few short years. Where these are not provided either by tapping more remote natural waters or by conversion of the non-potable waters, people and industry will go elsewhere. This becomes a real issue for the electric-power industry.

By aiding the development of the saline-water conversion industry these utilities will benefit from increased load and territory. By actively participating in combined electric-and-water distillation plants, such power companies may also gain power-generating capacity at costs below any now available.

1. Sonderman, G. E., "Today's Price for Fresh Water from the Sea," Consulting Engineer, February 1958
2. Coit, R. L., "Flash Evaporator for the Electric Utility Industry"
3. Calculations by Paul W. Anderson, Consulting Engineer, New York

TRANSFORMER COSMETOLOGY— HOW TO GET GOOD TRANSFORMER COATINGS)

Here is a comprehensive discussion of the problems and techniques of producing good transformer coatings that should help utilities in their refinishing work. Continuing study is expected to secure even better finishes. Future goals for finish development hold promise for still further improvements.

by LEROY HUTZLER, III
Supervisor—Process Engineering Medium Transformer Dept., General Electric Co.

CONTRARY to the adage, when judging transformers, beauty is more than skin deep. The beauty and durability of that skin is vital to a manufacturer's reputation with customers. Though it is recognized that excellent transformer finishes are available and being used, finish failures do occur.

The function of a finish is:

1. To prevent corrosion of the tank.
2. To provide an attractive appearance.
3. To improve the cooling efficiency.

Assuring Good Finish

To insure a good transformer finish, manufacturers follow the same beauty routine the ladies use:

1. Cleanse the face (provide a thorough surface preparation for painting).
2. Select personalized cosmetics (choose the proper paint for the job).
3. Cover the subject (produce complete film coating).

Finishes fail because some of this beauty routine was neglected.

Preparing the Surface

Surface preparation is the foundation of a good finish—in more ways than one. Medium transformer tanks are cleaned of rust and scale by shot-grit blasting. This process utilizes a high-pressure blast of air carrying abrasive steel pellets, which mechanically produce a clean, fine-sandpaper surface. Inspection and process control

maintain quality between too little and too much blast. An inadequate blast leaves scale or rust which can start underfilm corrosion, or can flake off, carrying the paint with it. Too rough a surface will contain deep pits and high pimples; valleys which must fill with paint before the peaks are covered. Even after several heavy coats, these peaks may be left essentially bare and subject to rapid rusting.

Proper Finish Formulation

From the wide choice of paint materials available today, Alkyd-Melamine has proven best suited for our service. It combines the outstanding film durability, flexibility, and adhesion of the alkyds with the better chemical and water resistance of the melamines. Film durability indicates that the resin film retains its protective quality under varied conditions of exposure, e.g., salt spray, humidity, sunlight, abrasion, and extreme temperature changes. It also provides a finish second to none we know of for outdoor and seaside exposure. When severe chemical exposures must be resisted, another type finish is substituted. In these cases, the increased chemical resistance is achieved at the sacrifice of other, less critical properties.

Complete Film Coverage

No finish can protect when it doesn't cover. With units of the medium transformer size it cannot be assured that sprayed paint covers hidden parts of tanks and

radiators. For this reason the flow coating process is applied. Hosed on, the paint can be made to flow into all areas, protecting every surface from corrosion. The essential point is that unless an adequate, unbroken film of primer and finish paint are present, the steel tank is subject to corrosion. Though a thinner film would be adequate if unbroken, quality is assured by applying at least three mils of paint on all outdoor units. When special colors are required, the practice is to flow coat first with standard finish to assure coverage. Then the special color can be sprayed on all visible areas for eye-appeal.

Flow-coating paint process used in the application of primer coats, assures paint flow over all surface areas and provides an unbroken protective film for transformer tanks.



TABLE I

Outdoor Exposure—
1 year

- Rusting
- Gloss Retention
- Salt Fog Resistance
- Humidity, Water, Hardness
- Accelerated Weathering
- Oil Contamination
- Chemical Resistance
- Adhesion
- Abrasion Resistance
- Flexibility

TABLE II

Rank Among 19 Systems						
System	Application	Natural Weathering	Salt Fog	Weather-Ometer	Chemical Resistance	Over-All Rank
A	Super Melaglyp Cold Spray	2	6	5	12	1
B	Super Melaglyp Hot Spray	3	1	3	9	2
C		4	5	16	19	3
D		7	10	2	10	7

TABLE III

SYSTEM RANK	ACCELERATED WEATHERING	CHEMICAL RESISTANCE	SALT FOG	FLEXIBILITY
Possible Score	5	5	15	3
Actual Scores				
1st (Super Melaglyp)	2—	3+	9	2
3rd			9	3
4th	3+	3+		
FINISH PROPERTIES			PRIMER PROPERTY	

One coat of primer and two coats of finish are applied to all tanks—each coat baked-on. Before shipping, a touch-up coat is sprayed on all visible parts to repair scuffs and scratches, and to glamorize the product.

Evaluating Finish System

A constant effort is carried on in the transformer industry to develop or procure better coatings. The following is quoted from a specification used in soliciting new or improved finishes:

“The finish must be suitable for continuous outdoor exposure and be resistant to salt spray, oils, humidity, and industrial atmospheres. It must permit easy re-finishing in the field.”

This specification was sent to paint manufacturers in 1956, initiating a major survey of the commercial finishes market. A description of the present system was presented—its general properties, method of application, etc. The test methods to be used were explained, and specifications described how samples should be submitted. All materials were color coded for test and were applied according to vendor’s instructions.

Grading Procedure

An objective, numerical grading procedure was employed for the study. The method permits weighting of properties according to their importance to any application. A point value was assigned to each of the properties studied. These properties are listed in Table 1.

A floor limit or minimum score was set on each property to prevent a sample from showing up well in over-all score while being completely unsatisfactory on a particular property.

When the study was complete, Super-Melaglyp was found to be best of 29 materials tested. In the dark gray field these finishes ranked first out of 19 materials tested. The light grays included several of these formulations taking the first places in a field of 10.

Individual Properties

On individual properties, a comparison can be made between

Super-Melaglyp and other apparatus finishes submitted for evaluation. Table II lists only the major properties which showed significant differences. The values represent rank among 19 blue-gray systems.

Of particular interest were several other systems that showed promise of excellence with just a little more development; these are being followed. A report was issued last year, describing in detail these studies and their results. This report was sent to all vendors of test systems with a letter identifying their system by code number and pointing out where it failed to be satisfactory. The leaders were invited to improve their one or two weak properties and submit new samples for test. The second evaluation program is now well under way.

Two Systems

In this follow-up program, two systems are of special interest. Their properties are presented in Table III. One system ranked third in the field of 19. In general, it showed very good properties but had a weakness in chemical resistance, and Weather-Ometer exposure. Note that both weak properties are primarily representative of the finish coat. Its outdoor exposure ranked well up in the field, bettered only by the Super-Melaglyp and one other system. Salt-fog resistance indicated that the primer was excellent. A second system submitted by the same vendor rated fourth in over-all score. Here the primer properties were poor. Salt-fog resistance and flexibility were unsatisfactory. However, the system showed excellent weather resistance, and in the Weather-Ometer its score was far higher than any other system. This pointed to a possible marriage between the primer from one system and the finish from the other. Such a combination is now on test.

Transformer Finishing Status

With all this evaluation and finish development going on, just how good is the product today? The test program confirmed Super-Melaglyp as an outstanding finish for normal and salt-spray exposures. Is this high quality really being achieved,



Before transformers are shipped, a touch-up coat is sprayed on all visible parts to repair scuffs and glamorize the product.

or is the finish being improperly applied so it will fail early? Is the beauty treatment being neglected?

It is no idle boast to state that today's quality level is consistently satisfactory and the best in history—and is likely to remain good. Several developments over the past year or two have contributed to this quality.

1. Smoothness of Surface Before Painting

The roughness of blast on medium transformer tanks has been reduced to less than half that of two years ago. This has been achieved by reducing grit size, using a softer, more malleable abrasive, and adjusting the abrasive feed to provide maximum ratio of abrasive-to-air in the blast stream. An immediate and very noticeable gain was achieved early last year by this last adjustment alone. The improvement can be seen, as well as measured, on production tanks.

2. Film Thickness

The 3-mil film has long been set as a goal, and attempts have been made to maintain

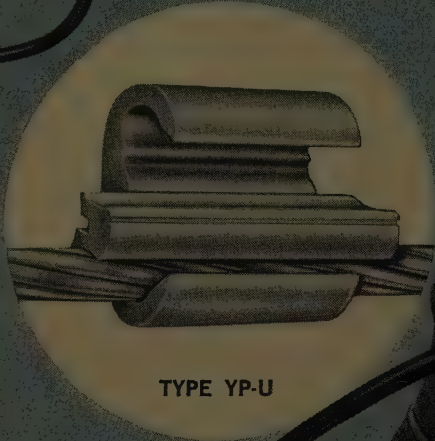
this thickness. However, conventional methods of measuring paint thickness over blasted steel have never been satisfactory. The blast itself has a radical effect on thickness readings. Development work has now provided means for accurate measurement of film thickness in the factory and has led to process changes which assure adequate film builds. It is now possible to prove that medium transformer tanks are being covered with 3 mils of paint.

3. Gloss and Color Control

While the above process improvements have all tended to increase the gloss level of transformer finishes, the over-all aim has been to produce a lower gloss surface. Low gloss gives the over-all impression of smoothness and avoids highlighting runs, dents, and other surface irregularities. To achieve this effect, the spray touch-up is being formulated to a semi-gloss level of about 30-40%. An additional advantage of lower gloss

(Continued on page 72)

FEWER, BETTER CONNECTORS



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MANAGEMENT-MARKETING

In Key Industry Pitch

Private Companies Bid: Complete U. S. Intertie

In possibly the most important industry presentation private power companies have ever made, investor-owned electric utility spokesmen last month delivered the picture of their big package—the near-future prospect of complete interconnection of the nation's power systems, integrated over decades past from hundreds of small isolated systems planned and developed to meet local needs—and, they depended heavily on local messengers to make effective deliveries.

Tie-in of the "home-town" story with the New York City revelation by EEI officials on Sept. 11 helped significantly to prove the key point: the electric power industry's present system of planning is the reverse of the concept which envisions the need to initiate electric power supply system growth at the national level. Of course, national media representatives (including EL&P's) had the wrapup of combined and coordinated member-company planning presented to them at the EEI press conference in New York. But, local executive comment and interpretation and announcement or review of local plans emphasized the primary objective of maintaining local control through investor-owned corporate action and financing such growth in the free market.

In the emphasis of national growth of transmission facilities,

important figures stressed are those representing proposed new investment (\$7.3-billion net) and anticipated additional miles of lines (100,000) by 1970. Yet, on the home front, references to plans like these demonstrated best the private enterprise initiative supporting growth of this magnitude and foresight:

1. Companies in the Carolinas and Virginias (Carolina P. & L., So. Carolina Elect. & Gas, Duke Power Co. and Virginia Elect. & Power Co.) announced new plans to coordinate and pool their power production and transmission facilities (including the utilization of transmission lines carrying 230,000, 345,000 and 500,000 as sections of a general area bulk power transmission grid, as well as to add more new connections and to extend and strengthen existing connections with still other neighboring utility companies.

2. New England companies in a six-state area described their expectations for \$100-million spending for transmission facilities between now and 1970 to extend a present network "generally considered to be one of the most completely developed in the nation," introducing to New England a 345,000-volt backbone circuit that will fully integrate New England with the rest of the northeast.

3. The five utilities in the Southern Co. group operating in a four-

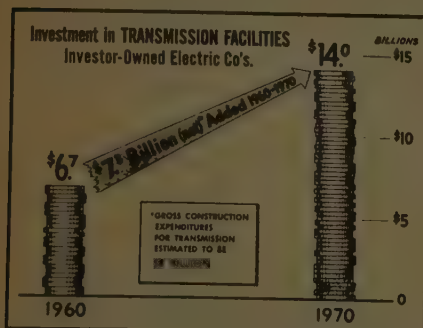
state area revealed that length of interconnecting 230,000-volt lines will be more than tripled and the integrated System's present investment of \$305-million in transmission facilities will be more than doubled by 1970.

And, numerous other companies could (and did) point to long-term records of steady development toward complete power interchange. Example: P. S. Elect. & Gas Co., which noted that it was "one of the pioneers in establishing interconnected facilities" and then discussed plans for adding 154 miles of new 230,000-volt lines in the next ten years among additional high voltage transmission facilities costing about \$145-million (in a \$1.2-billion, 10-year construction budget).

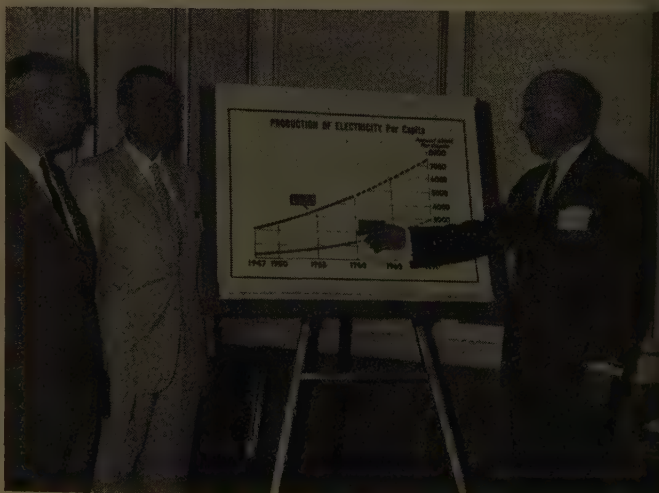
In the New York press conference, EEI Pres. Philip A. Flegler summed up the record to date: "Nearly all systems east of the Rocky Mountains (including 100 companies in 32 states) are now interconnected; while west of the Rockies, interconnected service has been a fact for several years." But, of course, in the New York presentation considerable attention was given to the "forward look."

The chairman of EEI's committee on power capacity and pooling, Charles E. Oakes, referred to a number of the "forward steps now going on all over the country" and

(Continued on page 84)



Last month the nation heard the investor-owned utility industry's plan for spending a total of about \$8-billion for extending transmission lines in the years from now to 1970 (chart left). EEI officials who spoke for the member companies (at right) are: Charles Oakes, Edwin Vennard and Philip Flegler.





**Collyer POWER CABLE with SILICONE INSULATION –
another progressive contribution to BETTER POWER
CABLE for HOT LOCATIONS . . . or for GREATER
CURRENT CARRYING CAPACITY . . .**

Here is why and how it will help you

Built to take heat

Collyer Power Cable with Silicone Insulation has remarkable heat resistance. Because silicone is a thermosetting material, it provides a homogeneous, non-hygroscopic, flexible, and elastic insulating wall over the conductors. The physical and electrical properties of this cable are unimpaired when operated in a continuous ambient temperature of 150°C . . . and these properties suffer no ill effects even with intermittent rises in ambient temperature to 200°C. This power cable's insulation feels like rubber — works like rubber — yet it provides longer and more satisfactory service life than rubber in hot locations.

Excellent ozone resistance

In addition to its heat resistance Collyer Power Cable with Silicone Insulation affords superior ozone resistance. This cable, then, is excellent for handling high voltages in hot locations.

Durable . . . workable

Although the insulation will burn when a flame is applied directly to it, Collyer Power Cable with Silicone Insulation will not support combustion. Should the insulation be burned by the direct application of flame, the remaining ash which will be held in place by the glass or asbes-

tos braid, has insulating properties, and the cable will still be serviceable on a temporary basis. Standard methods are used to install Collyer Silicone Power Cable. No kid-glove treatment is necessary. The insulation is tough and will withstand normal handling during installation.

A variety of constructions

Collyer Power Cables with Silicone Insulation are available in single or completely color coded multi-conductor cables with overall coverings of glass, glass and asbestos, or asbestos braids, or interlocked armor of galvanized steel or aluminum.

For more information ask your Collyer Distributor, Agent or write for Specification Data Sheets P-150 and P-151 to COLLYER INSULATED WIRE CO., 263 ROOSEVELT AVE., PAWTUCKET, RHODE ISLAND.

Collyer Cables



NUCLEAR NEWS

BY-PRODUCT VALUE OF A-POWER development was demonstrated last month when four utilities in the Carolinas and Virginias agreed on a basic pooling and coordination plan for operating power production and transmission facilities. (The action was an important demonstration of the integration EEI member-companies relied upon to refute the claims of some that planning of the nation's electric power facilities had to be directed by other than the managers of the investor-owned companies.) These neighboring companies (Carolina P. & L. Co., Duke Power Co., So. Carolina Elect. & Gas Co. and Virginia Elect. & Power Co.) joined together in 1956 to build and develop the first atomic power station in the southeast—expected to be in operation at the Columbia, S. C., site by the middle of next year.

"BIG STEP—BODEGA BAY"—In a new brochure titled "Electricity from the Atom," Pacific Gas & Elect. Co. traces the evolution of nuclear power through the projects in which it has been involved—from Dresden, Vallecitos, Humboldt Bay and Peach Bottom—up to the point where "the atom achieves its role of producing electricity to serve a large and diversified power market as reliably and economically as available conventional fuels." PG&E says "the atom will do this at Bodega Bay, Cal., where PG&E will build its largest atomic power project." Calling this "the big step," the PG&E brochure concludes: "When Bodega Bay is completed in 1965, PG&E will have accomplished the task it undertook in 1951—to establish the atom as a reliable, low-cost source of energy, helping to serve all of central and northern California."

NEXT MONTH: NUCLEAR WEEK—In Chicago during the week of Nov. 6-10, four key nuclear gatherings will hear reports on progress in atomic energy development: the American Nuclear Society, The Atomic Industrial Forum, Atom Fair and the National Youth Conference on the Atom. Speakers include AEC Chairman Glenn T. Seaborg and former Commissioner E. M. Zuckert, now Secretary of the Air Force. Scientists Hans Bethe and H. J. Bhabha (of India) head the list of notables who will address sessions in Chicago.

FAST REACTORS, FUSION PROGRESS—In two international Conferences under the sponsorship of the International Atomic Energy Agency in recent weeks, experimenters were encouraged to continue pioneer efforts aiming for practical goals now considered to be not too distant. In one conference, it was concluded that "fast reactors are gaining prominence as practical and economic power-producing machines of the future," though it was recognized that there is still "a long way to go to attain the same degree of

facility in the calculation and in design that exist with the thermal reactors." And, in the Fusion Conference, the IAEA viewed as successful its efforts to "stimulate further research, while avoiding unnecessary parallel work."

"A YEAR OF CONSOLIDATION" is anticipated by the IAEA, as it noted recently in an annual report to the international Agency's General Conference. "The direction and scope of future developments will be determined largely by the rate of advance of nuclear technology—and particularly the pace of its extension to the less developed areas," the report states.

TRANSFER OF REGULATORY AUTHORITY from the AEC to the states will be initiated in Kentucky beginning in December, after elapse of a 60-day period for public comment on a proposed agreement. The first such agreement to be executed by the AEC, covers licensing and control of radiation. Meanwhile, the state of New York has indicated that it does not see verbatim adoption of AEC's regulations as the proper way to achieve compatibility between the programs of the state and AEC. The director of N. Y. Office of Atomic development, Oliver Townsend, has expressed the belief that "If the states initiate their own programs for the regulation of atomic energy materials in accordance with the guidelines recommended by the Federal Radiation Council, their continuing best interests will be most effectively served."

A STUDY OF CANADA'S CANDU, the nation's first full scale nuclear power plant, is to be made by Allis-Chalmers for the U. S. AEC and Atomic Energy Canada, Ltd. The study, utilizing a digital computer, will determine power generating characteristics of the reactor core.



At Berkeley, Gloucestershire, on the estuary of the River Severn, the Nuclear Power Group of Britain will complete this 275-mw nuclear power station by year's end. (New plants in the U. S. planned for first operation in 1961 will be described in EL&P's Nov. 1 issue.)

"AS GOOD AS KERITE?"

We have Kerite cable that has been in service for well over 40 years. We think Kerite has the best designed signal and power cables that are made. Furthermore, we know that Kerite will stand back of its cable under any circumstances.

Now, what do you mean, "as good as Kerite"?

ENGINEERING OFFICES

More features make Westinghouse metal-clad switchgear

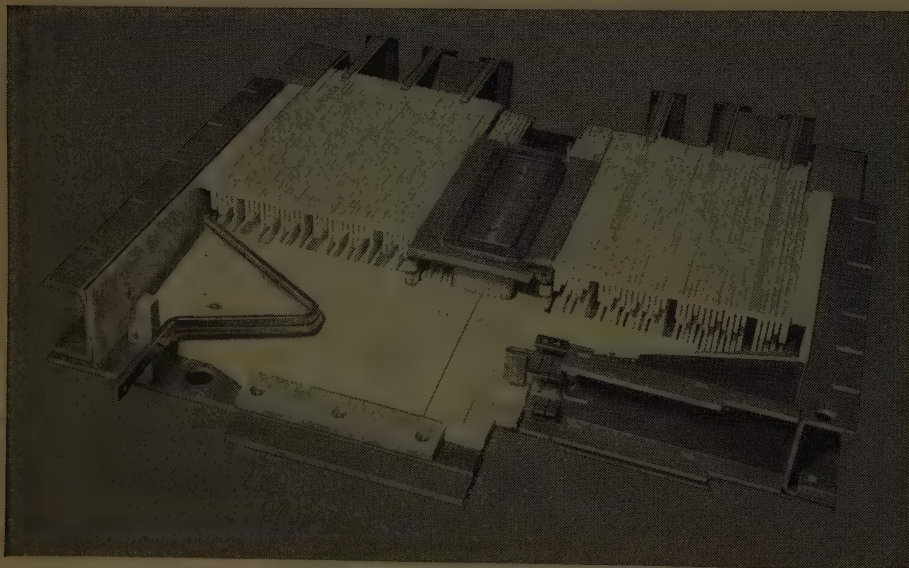
Westinghouse metal-clad switchgear is design proved in the Westinghouse High Power Laboratory. It meets all industrial, electric utility, commercial, institutional, and other needs for 75 to 1000 mva service inclusive, 4.16 through 13.8 kv.

Check below for advantages of this equipment that are of major importance to you.

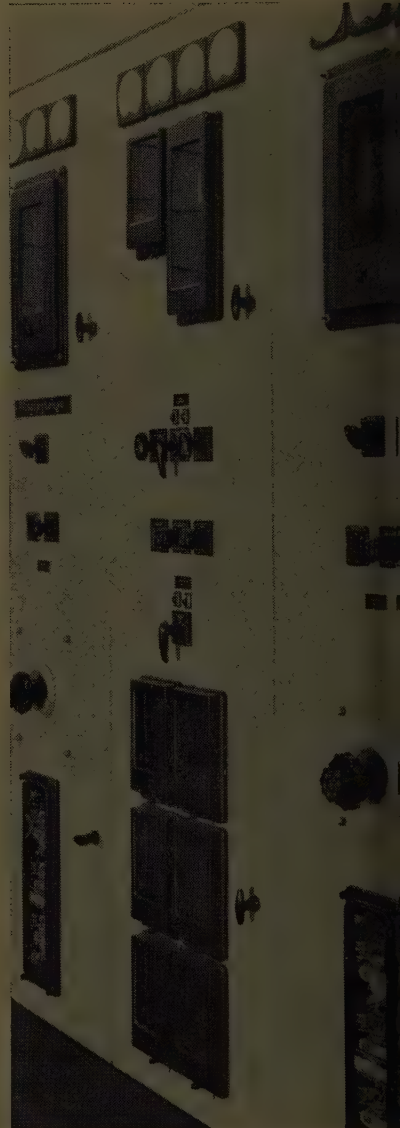
For further information, call your Westinghouse representative or write for a copy of Descriptive Bulletin 32-250 to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*



Balanced insulation protection is provided by the exclusive "Limitrak" insulation system on bus supports, arc chute enclosure and breaker bushings.



Fast, positive circuit protection is provided by the De-ion principle of arc interruption with center coil arc chute design.



Adequate space for varied relaying and instrumentation is assured by full height front panels.

our best buy



Proper component functioning is verified by a continuing program of production inspection and testing.



Front panel is protected during assembly, shipment and installation by stripable plastic coating.



Simple, quick inspection, maintenance and replacement of DH breakers is made possible by horizontal drawout construction.



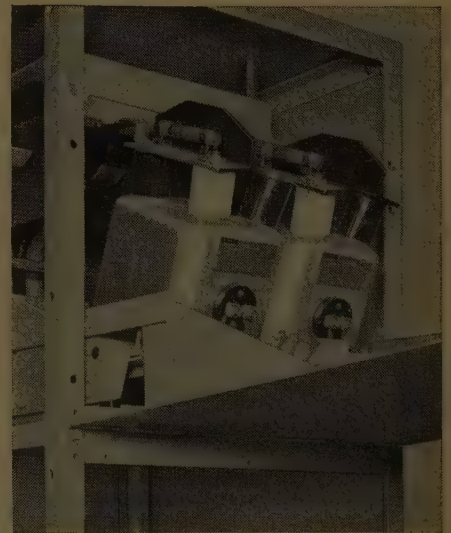
Hinged arc chute permits easy tilting for inspection and maintenance of contacts with DH breaker in drawout position.



Thorough phosphatizing and priming treatment safeguards against corrosion and provides a superior base for finish coat.



Complete joint sealing with polyester compound at main contact supports and main bus provides full insulation.



Personnel are protected by separate compartment drawout-type mounting of potential transformers.



Westinghouse

J-61014



REGULATORY REVIEW

New York Commission Grants Small Increase To Niagara Mohawk

New York PSC grants 2% increase, or \$3,740,000, instead of 6% requested by the Company.

The Company's claim of 6.23% rate of return reduced to 5.67% by the Commission.

Commission claims that substantial economies will accrue to Niagara Mohawk when it starts receiving power from the Niagara Project of the New York Power Authority.

Deferred Federal Income taxes arising from the use of Section 168 deducted from rate base.

THIS proceeding of the New York Public Service Commission not only established a bare-bones original cost rate base, but also allowed a rate of return which is tantamount to confiscation of property. The Commission's chief argument was about the potential savings which the Company would obtain when it starts receiving power from the Niagara Project of the New York Power Authority. These conjectural benefits which the Company could not estimate and the Commission seemingly was unable to spell out would not be fully available to the Company until 1964. It is unlikely that any contract between the Power Authority and a private utility is going to be particularly beneficial to the latter. It is also of interest to note how the Commission which so carefully sticks to a test year which has long since gone, seems to have no difficulty in looking forward to an unknown future to set rates which will essentially deprive the Company of its property, particularly under today's inflationary conditions. It is against this background that the dissent of Commissioner Mylott is of special importance to the utility industry.

The Commission's Forward Look

The Commission noted that in dealing with a wage increase which was signed practically at the end of the test period, the Company in-

cluded this wage increase as if it had been in force for the full 12 months. The Commission noted in its opinion that the witnesses for the Company

"... made no estimate of the company's ability to absorb the wage increase either in whole or in part through operational efficiencies or through growth or through changes and conditions occasioned or to be occasioned by the imminent receipt of Niagara Project Power."

The Commission pursued this line of attack by stating:

"Extended inquiries were directed to the company witnesses by Commission counsel and by counsel representing the opposing interests as to the impact of changes in operations ranging from the admittedly imminent retirement of certain of the company's electric generating plants to the prospective and imminent purchase of power from the Niagara Project of the Power Authority. The company witnesses conceded that the company made no attempt to forecast the effect of those changes, holding generally that such matters are extremely speculative. However, as was above indicated, the company did not perhaps deem it speculative in projecting its steam plant fuel cost data beyond the test period . . . ; or in projecting its systems capabilities, peak loads, gross and net reserve margins to June 30, 1961, and therefore one year beyond the limiting date of the test period . . . ; or in projecting its capabilities and peak loads through the year 1962 . . . ; or in projecting a reduction in capability rating study for each of its generating plants beyond the test period . . . ; or in projecting a chart showing 60-cycle system peak loads and capacity through 1962 . . . ; Also included in the company data applicable to the future were forecasts of the electric generating plants that would be placed on standby service following June 30, 1960."

In setting rates, the Commission said that it—

"... should be fully informed respecting known or contemplated changes or conditions in the respondents mode of operations to the extent that such changes or conditions differ from operations experienced during the test period, and also to the extent of abnormal or unusual conditions or costs or expenses encountered during the test year and not expected to recur in the immediate future. The information necessary for determination of these matters, while manifestly within the company's knowledge, was not fully disclosed. The company's witnesses were seemingly uninformed as to the company's requirements and dispositions for the immediate future and no studies were made by the witnesses or by the company to ascertain what effect the requirements or dispositions might have on the company's operations.

"The defects in the company's presentation, that is, in respect of items which the company made no attempt to adjust might be characterized as those for which adjustment amounts are readily determinable and those which cannot presently be adjusted because the company has not presented sufficient data to permit of a reasonably accurate calculation."

The Dissent of Commissioner Mylott

In dealing with the rate of return, Commissioner Mylott noted in his dissent that:

"A rate of return of even 5.67 percent to this Company approaches the point of constitutional inadequacy and unnecessarily invites judicial restraints upon our action.

"To my knowledge, this is the first instance in over a decade where the Commission has held that a utility in the Niagara Mohawk Power Corporation's class was not entitled to earn a return of at least 6 percent. As a matter of fact, this very Commission granted an increase in Niagara Mohawk's electric rates in May, 1959, sufficient to produce a return of well over 6 percent. There is nothing in the record or in the Examiner's report to indicate why this prior rate of return (in excess of 6 percent) should be reached to a range of 5.60 to 5.74 percent depending upon the manner in which the rate base is to be affected by the benefits of the tax savings through accelerated amortization.

(Continued on page 84)

HOLLOW CONDUCTOR . . .

(Continued from page 35)

result in a tension of 4300 lb at $\frac{1}{2}$ -in. radial ice, eight psf wind pressure at zero F. Long-term creep is still within anticipated range.

The hollow conductor is hung on 12 standard 15,000-lb suspension disk insulators with Preformed Armor Grip suspension clamps having 13 rods of 0.310-in. diameter per clamp. Line splices and strain clamps, adjustable compression type, were designed and made for us by Thomas & Betts. Aluminum rod fillers were inserted in the core of the "BX" under the compression sleeves as a precautionary measure although full-sized tests showed that a splice without the filler would hold the ultimate of the conductor. However, we were concerned with long-term holding power due to fatigue. The filler assures that such fatigue will not occur.

While more or less experimental, the hollow conductor has proved itself in our territory by tests and 5 years of operation. Admittedly, our conductor tension is low in comparison with that used in the midwest where spans of 1,000 ft are average. However, use of alloyed aluminum wires, such as AAAC or 5005, can be used to beef up the strength. Very little can be done with the core which adds only about one percent to the strength of the assembly.

The hollow aluminum conductors are supported on modified H-frame structures which are called "Polarm" structures due to the fact that the cross-arms are creosoted Southern Yellow pine poles. Such structures have been described in other articles. Briefly, this design permits the use of $\frac{3}{8}$ -in. common steel galvanized aerial static strand because it is offset from the conductors to such an extent that it will not contact the conductors if it does break. This location of the static strand also provides a minimum of about 20 ft of wood for impulse insulation, the equivalent of about 25 standard porcelain 10-in. x $5\frac{3}{4}$ -in. suspension insulators on steel crossarms, at three microseconds on a $1\frac{1}{2}$ x 40 wave.

The crossarm spans 36 ft between

the vertical poles, too much for a standard single pole even though it is only supporting the light hollow conductor. Based on our experience with timber connectors, we decided that we could reinforce the 45-ft crossarm by bolting a 30-ft pole on top of the 45-ft arm as shown by Fig. 1. Accordingly, a full size test of the crossarm was made. By a judicious use of timber connectors of the Malleable Iron Fittings type to develop the shear, we were able to make the arm strong enough to take the vertical design load without deflection.

The angle strain structure is self-

contained, no guys being necessary. It was developed for locations where guying is impractical due to space limitations on the Right-of-Way. Fig. 3 shows a typical view of this structure. The simple, clean lines of the clamps and jumpers are evident. A description of these accessories was published in the December 15 issue, Page 83, of *ELECTRIC LIGHT & POWER* magazine.

Altogether, performance of the wood-pole twin lines has been very satisfactory, indicating that the departures in design of conductor and structures were justified in view of operating requirements.

EEI Computer Applications Task Force Shares Work

By C. H. HOFFMAN, Sponsor,
Assistant To System Planning,
and Development Engineer,
Public Service Electric and
Gas Co. (New Jersey)

"Share Work on Active Programming" is the motto of the Edison Electric Institute's Task Force on Computer Applications for Utility Engineering established to foster cooperation in computer applications.

The task force has been directed to spend its major effort on actual development and preparation of programs for solution of electric utility engineering problems. Emphasis is on industry orientation rather than computer orientation. The task force is primarily interested in cooperation during the formative stages of program development. Thus results will be useful to many groups. It does not intend to publish lists of available programs similar to AIEE publication S-109-A. Instead, it will serve as a means of exchanging information among its programs newly completed or in progress.

The task force is sponsored by the System Planning Subcommittee of the Electrical System and Equipment Committee of EEI. It is organized into six working units covering the following areas:

1. Network analysis
2. Generation and transmission planning
3. Distribution planning and performance
4. Power plant performance

5. System and economic performance
6. Station piping and structural design

Each working unit has from 30 to 50 members, designated either "correspondents" or "associates," appointed by the System Planning Subcommittee chairman. The term "correspondent" applies to individuals designated by EEI member companies. A few electrical equipment manufacturers, computer manufacturers, and educational institutions have been invited to nominate individuals for appointment as associates.

Correspondents and associates function as communication channels between other members of their units and all interested persons within their own company. Actual computer programs are developed by project teams grouped under the appropriate working units. Members of these teams need not be correspondents or associates but are individuals selected by their organization to cooperate on a particular programming project.

The task force has sponsored several working unit meetings for interchange of ideas and has helped initiate cooperative programming efforts in the areas of:

1. Power flow; 2. Short-circuit current calculations; 3. Transformer load supervision; 4. Distribution interruption analysis; 5. Steel structure design; 6. Fluid properties; 7. Generator short-term outage cost; 8. Generalized heat rate calculations.



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RUSTABLE STRAND GETS WEAKER — ALUMOWELD STRAND KEEPS ITS STRENGTH

When you buy strand you want the strength you specify—and you want that strength to last. So why waste good money on ordinary strand that can't resist corrosion—that starts to rust away and weaken *after* you install it. Unlike rustable strand, Alumoweld's initial strength remains permanent year after year.

With its *thick* covering of aluminum—25% by area—permanently welded to a strong steel core, Alumoweld gives you the same high resistance to corrosion as solid aluminum. It's made by the exclusive atomic-welding process in which the ductile weld remains permanent under all operating conditions. Corrosive elements can't reach the steel core because of the

durable protection of the *thick* aluminum covering.

Diameter for diameter, Alumoweld Strand has the same strength as extra-high-tensile steel—yet, it weighs less and is easier to install. Its initial cost is surprisingly low. In fact, because it will stay up far longer, Alumoweld Strand will actually *cost less* as the years go by.

Alumoweld Strand gives you performance where it counts—on the job! Send for Engineering Bulletin E. D. 3000 and get the full story on Alumoweld's important, money-saving advantages. You'll see why Alumoweld Strand is preferred by so many efficiency-minded, cost-conscious companies.

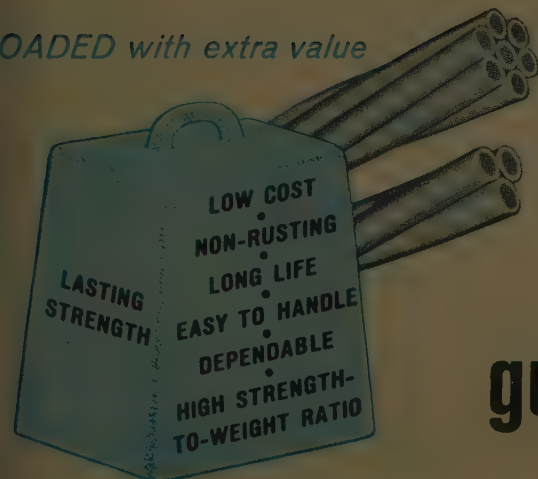
Supplies of Alumoweld Strand are available for immediate shipment from our warehouses in New York, Chicago, Pittsburgh and Memphis.

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UTILITY MAN'S NOTEBOOK

A Successful Method of Keeping Condensers Clean

By GUY WITMER, Superintendent of Production,
Savannah Electric and Power Company, Savannah, Ga.,
and SAMUEL M. ARNOW, Consulting Engineer,
C. H. Wheeler Manufacturing Company,
Philadelphia, Pa.

The Riverside Station of Savannah Electric and Power is situated on the Savannah River, about 18 miles from the ocean. The river has the usual complement of debris and suspended matter and, being so close to the sea, is also subject to tidal effects which alternately change condenser circulating water from fresh to brackish. In addition, the condenser intake is adjacent to a main city sewer and downstream from a large paper mill. Between the two, the condensers get more than their full quota of organic and suspended matter (the latter reaching as high as 5000 ppm), bits of tree bark, tannic acid, and almost any objectionable matter one can name.

In this station are eight turbines ranging in size from 3000 to 44,000 kw. Condensers vary from single pass to modern dual-bank, laned, deaerating types. The first five machines are used for peaking.

The three latest turbines, Numbers 6, 7 and 8, have modern divided water box condensers. Number 6 has no special washing provisions; number 7 has a butterfly type reversing valve; number 8 is equipped with C. H. Wheeler patented sluice type, hydraulically operated reverse flow valves.

One-half of number 6 condenser has to be removed from service once a week and manually cleaned, an operation which takes about four hours. Frequency of cleaning is determined not only by the drop in vacuum but also by load requirements and available capacity. At times this machine must operate at a

substantial back pressure and thus suffers the economic penalty which such operation entails until the load situation eases enough to permit cleaning the condenser.

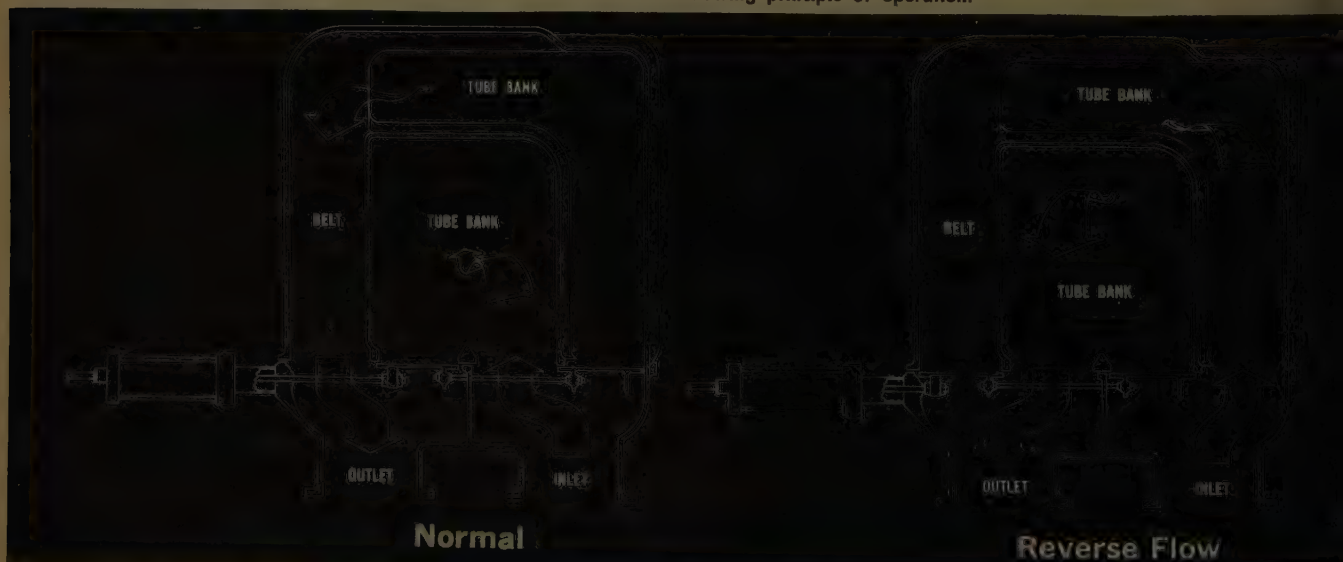
Number 7 condenser has a butterfly type reversing valve which allows hydraulic cleaning of the tubes. It is subject, however, to operating complications. Its design results in high water velocity through one section of the condenser during the reversal operation, which causes a twisting moment on the turbine exhaust flange. In order to avoid such high flow, one circulating pump must be shut down. This is a complicated procedure. It introduces an extra operating step in the condenser cleaning cycle and presents the possibility of an operating error in cutting equipment in and out.

In addition, the valve requires a complicated additional outside piping system.

Number 8 machine, which went in service in June 1956, is a 1250 psi, 950F, straight-through turbine generator, having a nominal rating of 30,000 kw. It has, however, been operated at a much higher load, sometimes carrying as much as 45,000 kw.

Accordingly, the 32,500 sq ft C. H. Wheeler dual-bank condenser is equipped with two C. H. Wheeler patented sluice type, hydraulically operated reverse flow valves. Their operation has been so successful and trouble-free and the condenser vacuum so consistently maintained, that it was not felt necessary to remove the condenser from service for inspection of either tubes or water boxes. However, when after three and one-half years of continuous operation, the turbine was opened for routine inspection, it was decided to take advantage of this opportunity and to open the water box manholes. The circulating water passages were found to be in such excellent shape that the cover was replaced without any further work.

The Wheeler reverse flow valve showing principle of operation.



Maintenance of the valves has been practically negligible. Flow is reversed once a shift and the cleaning operation takes about 15 minutes. Earlier experience showed optimum rate of flow reversal to be two minutes, an orifice was installed in the hydraulic control circuit to limit flow of circulating water so that the valves operate within this time. The two valves of the Riverside condenser are operated about an hour apart. At about 8 pm, one valve is reversed, as indicated by a very slight drop in vacuum, followed by immediate recovery. The valve is left in that position for about an hour. The valve on that side of the condenser is brought back to normal about 9 pm and the second valve is then reversed. The condenser runs for an hour in this manner and then the second valve is placed in its original position, completing the cycle. The vacuum is not affected by direction of circulating water flow, proving the inherent correctness of the design of the condenser proper as well as the air-cooler and offtake system.

The successful experience with the C. H. Wheeler reverse flow valves at Riverside Power Station, led to their incorporation in the condenser of Number 1 Unit at Port Wentworth Power Station, the company's latest and most efficient installation. This unit has a 1450 psi, 1000F turbo-generator, with 1000F reheat. Its name plate rating is 44,000-kw but it is capable of operating at 52,000-kw. It is equipped with a C. H. Wheeler 35,000 sq ft dual bank condenser, with reverse flow valves similar to those of the Riverside condenser. Operating experience with this condenser has been just as satisfactory as the experience at Riverside Station. In fact, a gage glass at the top of the heater box shows that circulating water level during the reversal cycle does not vary much more than one inch. The two valves operate in immediate sequence; otherwise the operating procedure is like that at Riverside.

The second unit of Port Wentworth Station, scheduled to go in service in May, will have a condenser with reversing valves similar to Unit Number 1.

Indexed Maps Speed Rural Customer Locating

By ROBERT NEFF
Engineer's Assistant
Indiana & Michigan Electric Co.
Elkhart, Indiana
AEP System

Where up-to-date maps and street guides are not otherwise available, especially in new rural subdivisions, an indexed book of road maps has proved to be a great aid in providing efficient operations for many departments. The result has been better service for customers, saving in construction costs and time, faster restoration of service, and saving time when making appliance deliveries. This plan also saves extra trips to remote locations, and is an aid in routing rural meter readers. It has minimized many distractions in the engineering department, reduced the time required to search out various locations,

and has eliminated the booby trap of duplicate names of streets in more than one rural subdivision.

Formerly, streets in rural areas were located by reference to distribution record maps and the assistance, usually, of someone in the engineering department familiar with the new and existing subdivisions. This was not a good answer, since many of the street names were duplicated in more than one subdivision. Because the streets generally were not marked, reliability of this method depended too much upon past experience of the person seeking the location.

The new road maps were sketched from recorded maps showing details of the individual allotments and drawn to a scale 4 in. to the mile. Prints were made and fastened into 9x11½-in. plastic binders. An index of more than 400 street names was also included. This provides a convenient, indexed, and portable record for trouble men, servicemen, and others in our district to carry in their company cars or use in the office for ready reference.

Indexed book of maps sketched from records of local governmental unit helps crews find unmarked streets in new rural allotments.





MANUFACTURERS-DEVELOPMENTS

G. E. Introduces New Area Lighting Line

With a significant expansion of its product line, and a new and greatly simplified application guidebook, "Area Lighting Designer's and Buyer's Guide," General Electric has launched a major area lighting marketing program.

The company has added two new mercury units and two fixtures utilizing Quartzline® lamps to its traditional line of floodlights. Rounding out the new luminaire package are three post-mounted units: one for incandescent only, one for mercury and incandescent, and one fluorescent. In addition, a "Quick Response" photoelectric control has been developed.

The new mercury units are available in two sizes, up to 400-watt in the smaller size, and 700-, 1000-, or 1500-watt in the larger size. Both models resemble small television sets in appearance, and are intended for applications where a wide angle beam is desirable.

In the incandescent line, General Electric has made available two models employing the Quartzline® lamp, with its higher lumen output,

tightly controlled beam, longer life, and high-lumen maintenance. For these lamps, the company has developed the QF-500 (500-watt) and the QF 1500 (1500 watt). The units are marked by a very wide horizontal beam, and a very narrow vertical beam with sharp cutoff.

Designed primarily for mercury, but accommodating incandescent as well, is the PMA-115—a canopy-covered luminaire with a shatter-resistant acrylic-plastic refractor.

For fluorescent applications, the company has added the PMF-104—the only post-mounted fluorescent fixture on the market according to the company. The unit is designed for 10- to 20-ft mounting heights, carries a single four-ft, 6,900-lumen Power Groove® lamp, and cants into the sky with lines that will blend with modern architecture and landscaping.

For incandescent lamps only, G. E. has produced the inexpensive PMG-114, with a "coolie-hat-design" canopy and rippled-glass globe. The PMG-114 will take up to a 6,000-lumen, 405-watt lamp. The unit gives a soft, practically glare-free light distribution of a circular shape (i.e. type V).

Burndy Opens New Belgian Factory

Burndy Corp., manufacturer of electrical connectors, has opened



new 25,000 sq ft plant in Malines, Belgium for its wholly-owned Belgian subsidiary, Burndy Electric S. A.

The modern one-story structure houses the administrative, technical services, production and warehousing facilities for Burndy's European operations.

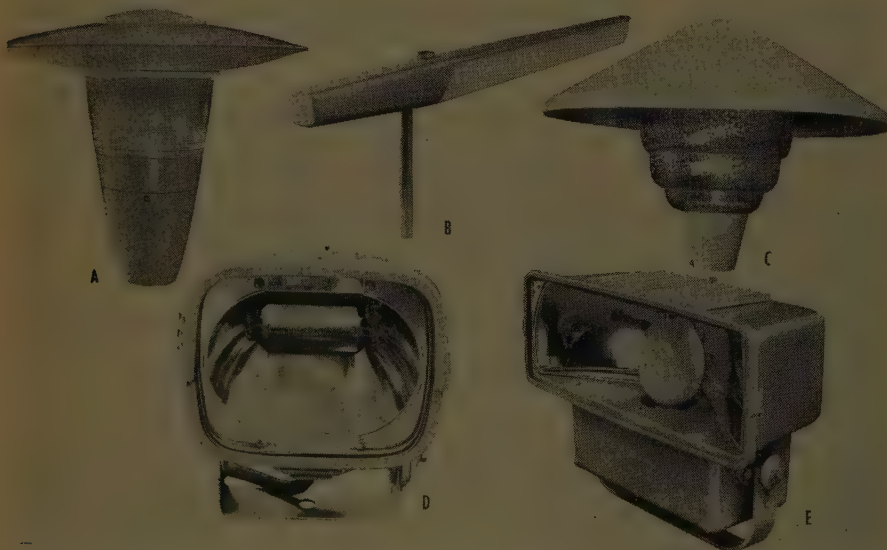
Connectors manufactured in the new plant will be marketed through sales subsidiaries in West Germany, Switzerland, France and Italy and through sales representatives in Belgium, Holland, Denmark, Sweden and Austria.

Westinghouse Scientists Develop Super Sensitive Electronic 'Sniffer'

Our sense of smell is sensitive enough to detect certain odors in concentrations as little as one part in a million parts of air.

But scientists at the Westinghouse research laboratories have developed an electronic "sniffer" that is even more sensitive and much more accurate. It not only detects, but exactly measures, concentrations of gases as low as one part in 10 million parts of air.

In contrast to the human sense mechanism, odor has nothing to do with its operation. Called an electronegative gas detector (EGAD), the new instrument was developed primarily to detect and measure



Typical applications of G. E.'s new area lighting equipment are: A, B, C for parks, walkways, entrance roads and pedestrian malls. D and E are especially suited for sports activities such as racetracks, trampoline centers, football fields; these are also used for industrial work areas and airport service areas.

the concentration of a gas called sulfur hexafluoride (SF₆).

Essentially, the instrument takes air suspected of containing SF₆, bombards it with electrons, and sorts out the SF₆ by its extra tendency to attract the electrons.

The instrument can detect a leak so small that the escaping gas, in an entire year, would fill only the space inside a pack of cigarettes.

Alcoa Develops New Aluminum Alloy

A new aluminum alloy, 3002, has been developed by Aluminum Company of America in response to increasing demand for a lower-cost specular lighting reflector material.

Designed to provide maximum formability, 3002 alloy is a non-clad aluminum material, available in sheet circle form. When finished by the Alcoa Alzak® process, the new 3002 alloy sheet displays the same reflecting characteristics long associated with the Alzak® process.

Use of the new non-clad Alcoa reflector sheet eliminates a problem in the use of clad sheet, where buffing sometimes removes the buffing of unusually contoured reflectors.

Pennsylvania Transformer Gets New Service Policy

Pennsylvania Transformer Division, McGraw-Edison Co. has announced a new service policy on furnishing field installation engineers. In the larger unit ratings, engineers will be furnished for a specified number of days at no charge, otherwise, time is invoiced at a designated rate per day. Field installation engineers may be requisitioned by the customer for units which do not qualify for free service.

CA Develops Faster Data Transmission

Development of electronic equipment for transmitting data to a computer thousands of miles away, at a pace 3,000 times faster than by typewriter, was announced today by T. A. Smith, executive vice president, Electronic Data

Processing, the Radio Corporation of America.

The new RCA equipment is designed to work with magnetic tapes employed with RCA data processing systems, or tapes from computers of other origin.

"The only real speed limitation on the equipment," Mr. Smith said, "is that imposed by the operating rate of the communications medium used, whether normal telephone facilities, leased lines, or microwave. It is possible to transmit more than 18,000 data characters in a single second with existing public carrier facilities."

A version of the equipment would permit operation at even higher speeds, such as at the 66,000 characters per second rate of modern computer magnetic tape transports.



Sharing the cake cutting honors at Line Material Industries' 50th anniversary celebration is W. D. Kyle, founder and president of the company. The big cake was presented by long-time friends of L-M, The Fargo Manufacturing Co., Poughkeepsie, N. Y.

Sangamo To Relocate Facilities

Sangamo Electric Company recently announced a program of realignment and relocation of production facilities, including expansion of a present plant, and construction of a new plant in South Carolina. The program was initiated to improve manufacturing efficiency and to anticipate growth of its defense and electronics business.

A first step in the program will be an immediate 65,000 sq ft expansion of the Pickens, South Carolina, plant, and the transfer to this modern existing plant the capacitor production now located at Marion, Ill. The Marion Plant will be closed.

Construction will be started at
(Continued on page 76)

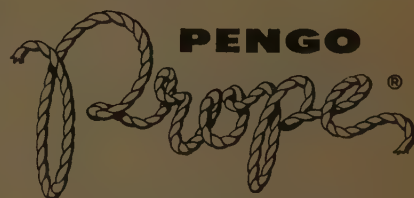
PENGO AUGERS

Save you money
4 ways



PENGO HEAVY-DUTY Twin Helix Augers—14" through 96" hole diam.

- 1 **BORE FASTER...** put real "teeth" in earth drilling, save wear and tear on your diggers.
- 2 **STAY ON THE JOB LONGER** ...all wearing parts replaceable in the field; no down-time for shop welding.
- 3 **COST FAR LESS TO MAINTAIN** ...reversible teeth cost only 90¢ each, pilot bit only \$8.00. Parts interchangeable on all PENGO augers you are using...less inventory!
- 4 **A SIZE AND TYPE FOR EVERY BORING JOB...** Augers and boring heads (for welding to your present auger) available for every make of machine from post hole diggers to largest heavy-duty earth drills. Write for catalog.



— the most satisfactory construction rope available today!

- * **GREAT STRENGTH**
(8,200 lbs. for ¾" diameter)
- * **LIGHT WEIGHT**
(11 lbs. per 100 ft. ¾" diameter)
- * **HANDLES AND SPLICES LIKE MANILA**
in any climate or weather
- * **WATERPROOF**
(even salt water); can't mildew or rot. Excellent dielectric properties.

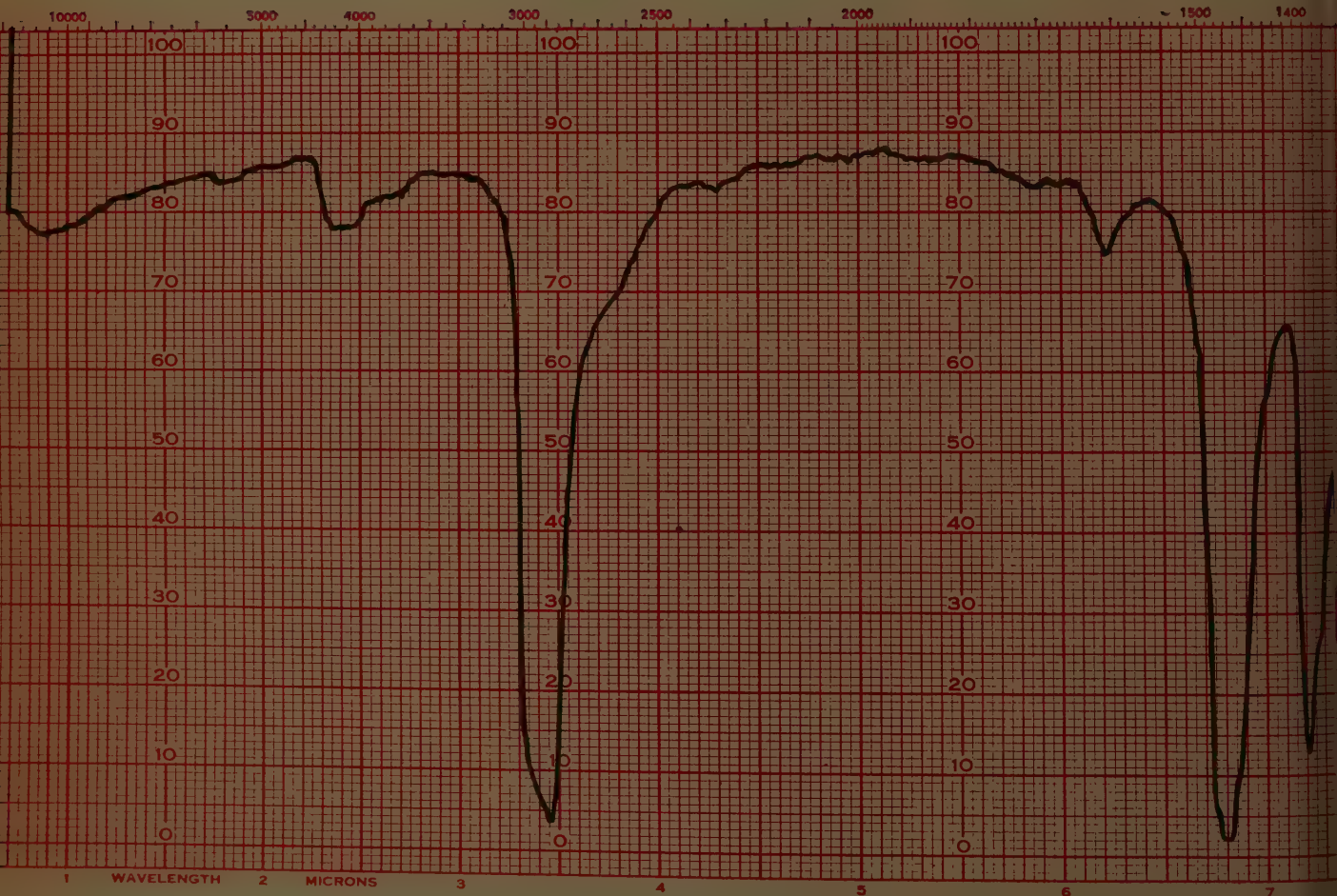
PENGO-Rope is a synthetic rope of special construction available in all popular diameters from ¼" to 2"; regular construction in sizes smaller than ¼". Write for specifications, prices.



PETERSEN
ENGINEERING COMPANY, INC.
Santa Clara, California
Axminster 6-7712

If it's electrical cable, pure as the driven snow isn't pure enough. Take the oil saturation for paper cable, for example. Even tiny impurities, one part in 10,000, will affect the performance of the cable. Our Research and Development Department uses an infrared spectrophotometer to establish standards for each type of saturating oil. These standards, using both qualitative and quantitative spectroanalysis, are so high that they are beyond the limits of normal organic analysis. Using spectroanalysis graphs, like the one below, our research department can determine the composition and the molecular structure of organic materials in their original state. Changes in the structure and composition after actual or accelerated service tests can also be detected. Only the oil saturation

This is what purity looks like



at can pass these tests are pure enough to be used in USS Tiger Brand paper cable. This is just one of the many ways our Research and Development Department makes sure the quality of USS Tiger Brand Wire and Cable is the best that money can buy. Our research laboratory studies and evaluates all the materials used in Tiger Brand products. We are always experimenting with new materials and methods to make a better cable for you. We have the facilities, right in our laboratory, to make all kinds of experimental cables—from control cables up to high voltage cables.

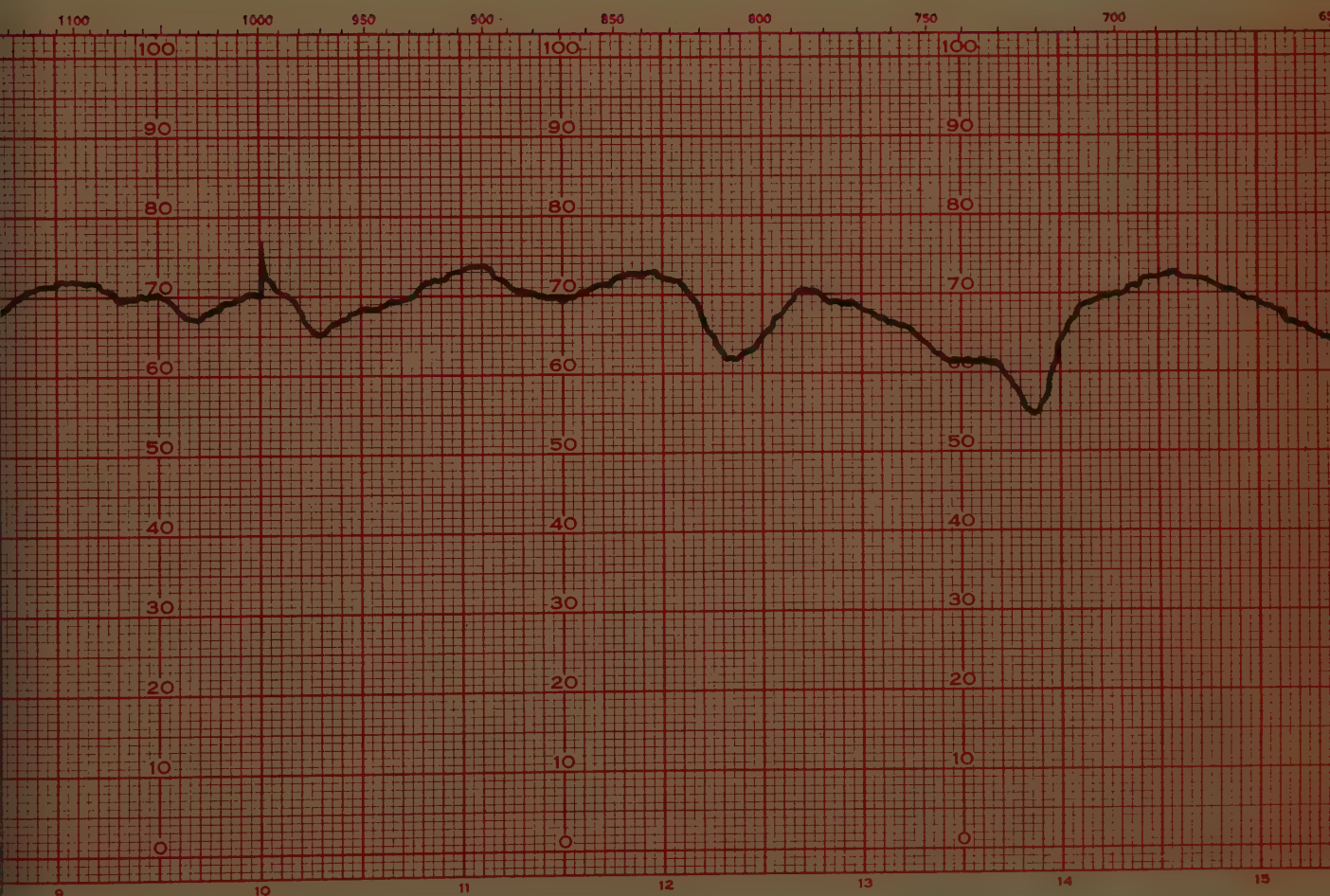
That's why, whatever the job, it pays to specify USS Tiger Brand Electrical Wire and Cable. American Steel and Wire, Dept. 1433, Rockefeller Building, Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks



American Steel and Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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for Safe WIRE STRINGING



Bashlin's precision built **TRAVELING GROUND**



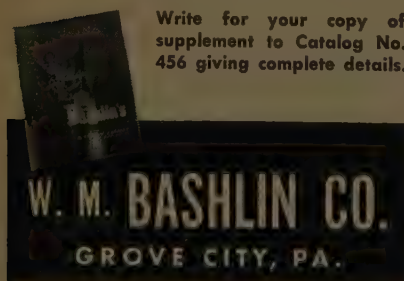
No. 795 Close-up view of the new Bashlin Traveling Ground for Safe Wire Stringing.

Here are features of the Traveling Ground you will recognize as essential for Safe Wire Stringing. 1. Positive ground. 2. Light weight. 3. Eye for hotstick pickup. 4. Bronze oiled bushings. 5. Brush pickup with shunts to common ground. 6. Brass shoulder bolt axle. 7. Adjusts for conductors to and including 795,000 cm. ACSR. 8. All parts replaceable. 9. Shouldered pin to attach ground clamp. 10. Operates in either vertical or horizontal position. 11. Can be installed without threading through. 12. A Heli-Coil thread is used in the frame.

Distributors in Strategic Areas in U.S.A.

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Write for your copy of supplement to Catalog No. 456 giving complete details.



TRANSFORMER COSMETOLOGY...

(Continued from page 43)

is the greater ease of color matching between transformers and related equipment. This improvement is realized immediately when gloss finishes are used on related apparatus. The proximity of a very high and a low gloss tends to emphasize the difference in texture, and thus exaggerates slight variations in color.

When an unusual corrosive application is specified, appropriate paints must be supplied. In these cases, a corrosion-resistant resin system is formulated in standard transformer colors. The most common of these is an epoxy finish supplied for certain acid and alkali exposures. This type paint resists the chemical exposure conditions extremely well. In exchange for this chemical resistance, other properties are sacrificed, i.e. gloss and color retention, and flexibility of film. In chemical service these properties are secondary to protection against corrosion.

Other Coatings

Questions are constantly being raised as to the suitability of other finish systems for medium transformers. The Melalast coating applied to distribution transformer covers was developed primarily as an electrical insulation — protection against short circuits and electrocuted squirrels. The pre-heated cover is dipped into a bed of powdered resin suspended in air. The suspended powder melts onto the hot metal surface, producing a uniform coat about 15 mils thick. A high temperature bake then cures the film. This coating has not been considered for medium transformers because the need for an insulating film does not exist. The acrylic lacquer being applied to switchgear cannot be used on medium transformers. As a class, lacquers are simply not compatible with present transformer design, because they must be applied by spraying. Medium transformer tanks which have hidden surfaces, such as cooling tubes, must be flow-

painted in order to cover all parts of the unit. The acrylic finishes do have some outstanding properties. For purposes of comparison, the acrylic lacquer has been included in the present evaluation series, along with several acrylic enamel systems.

Future Goals

Among goals for the future in finish development, three aims stand out above all others:

1. Eliminate Underfilm Rust Creepage

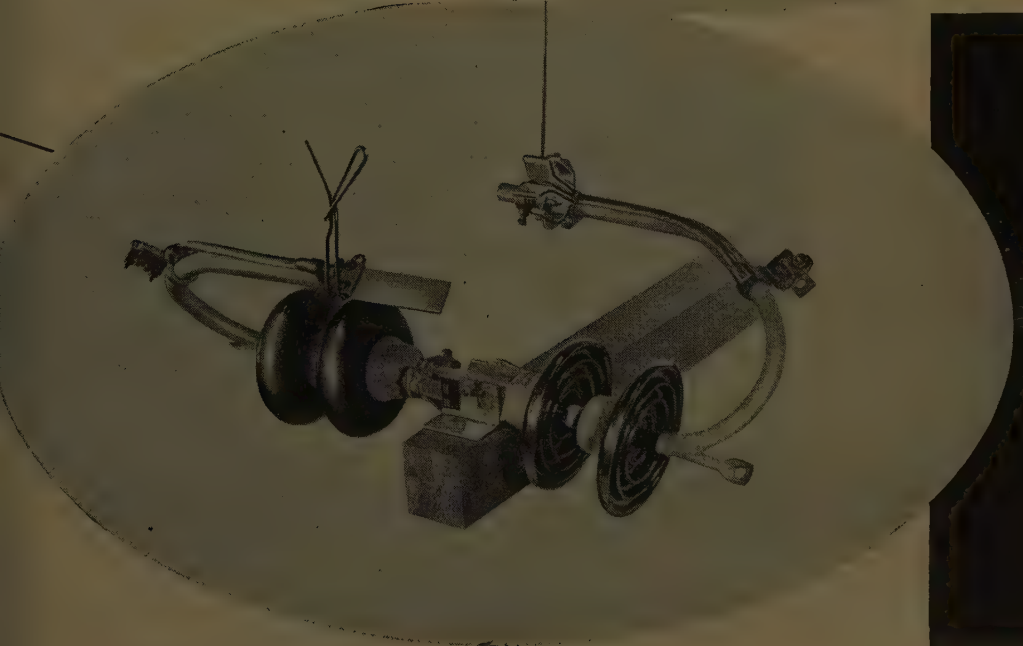
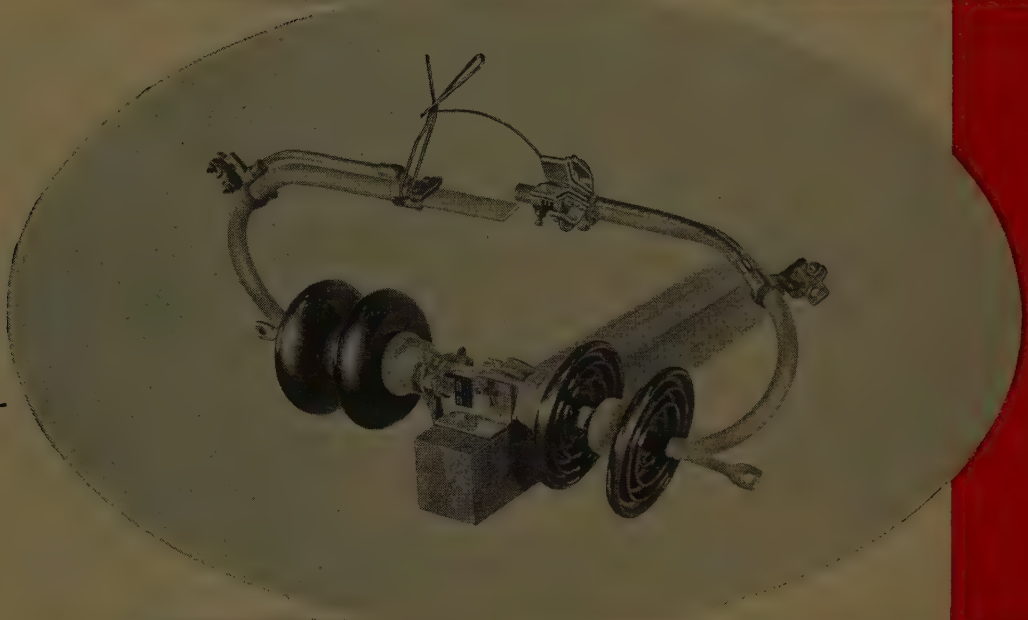
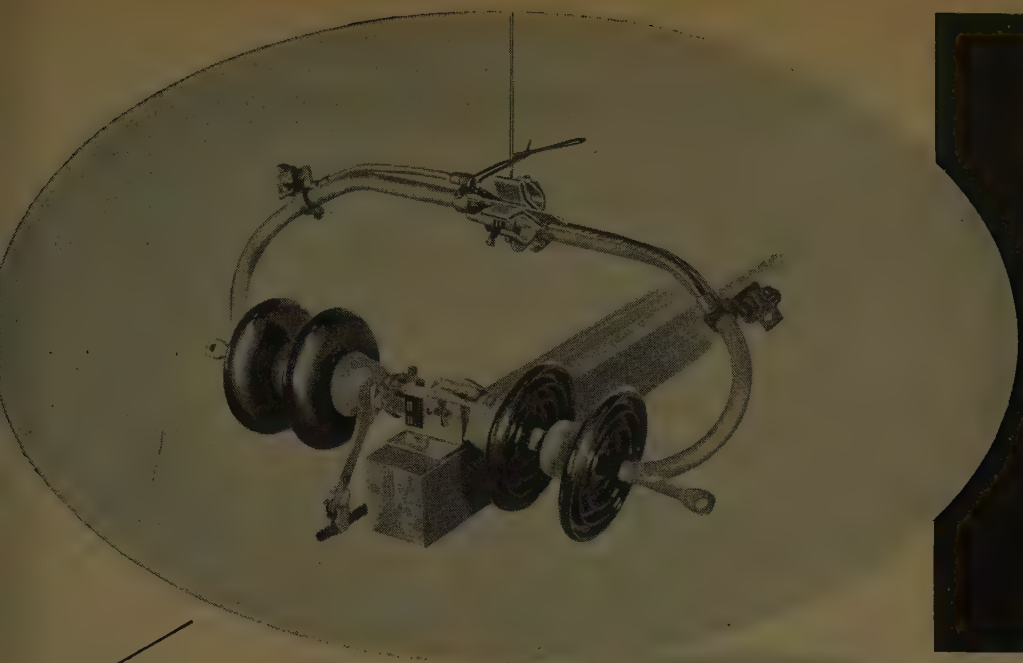
Several different approaches to this problem are now under development. They all involve either surface preparation processes or modifications to the primer coat. Considerable progress has been made in this work which is aimed at the primary goal of providing better finishes — the goal of preventing the spread of rust started at a thin or damaged spot in the film.

2. Improve Chemical Resistance

While there are chemical service finishes, they are non-standard. They require special ordering and special handling and are inferior to standard paint in some properties, principally salt fog resistance and natural weathering. A great contribution could be made by developing an all-purpose finish — a standard paint system that would serve in chemical atmosphere.

3. Improve Gloss and Color Retention

This is exclusively an appearance feature, but none the less, valuable. Many times the appearance problems may be more annoying than actual performance problems. A non-chalking finish that retains its original appearance would probably double the customer's time between repainting jobs. How much refinishing is done because apparatus looks weathered and old, when it is actually performing well and would continue to do so for years? This is probably the case with more than half the repainting done in the field.



(Continued from page 69)

once on a new 150,000 sq ft plant in Walhalla, S. C., for the manufacture of certain types of single-phase electric meters now produced at Springfield. The Pickens and Walhalla plants will be operated as one division of the company.

Bituminous Coal Research, Inc. Moves To New Center

Bituminous Coal Research, Inc. has consolidated its Columbus, Ohio, and Pittsburgh research activities in the coal industry's new research center at Monroeville, Pa.

The research center, with its equipment, represents an investment of more than \$1,000,000. Funds were contributed primarily by the coal industry, with substantial aid from electric utilities, other major coal users, and companies which supply materials and equipment to the coal industry.

The research program will emphasize development of improved coal utilization methods and equipment. The new laboratory can accommodate a staff of 80 to 100, depending on the nature of research being conducted.

Griscom-Russell Buys Rights To Elliott Deaerating Heaters

The Griscom-Russell Co., of Massillon, Ohio, manufacturer of power, process, nuclear, marine and industrial equipment, announced the purchase of the exclusive rights to manufacture and sell deaerating heaters using designs and patents of Elliott Company, of Jeannette, Pa., a division of Carrier Corporation.

Surety Installs Electronic Air Cleaner

Lineman gloves are now being manufactured by the Surety Rubber Co., Carrollton, Ohio, in a building where air-borne dirt—the cause of most rejections of this strictly supervised item—is eliminated by an electrostatic system of filtering the air.

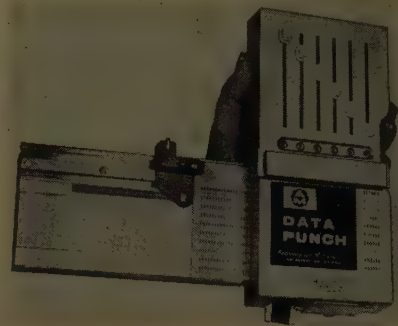
Surety has completed the installation of an electronic air cleaner, including modifications to the building to accommodate the unit.



NEW PRODUCT DESIGN

Portable Key-Punch

One of the deterrents to broader application and increased use of



data processing equipment—tedious data gathering—received a boost recently when Addressograph-Multi-graph Corp. announced availability of a new "Tom Thumb"-sized business machine to be known as the Addressograph Data Punch. Essentially, it is a portable data punch for recording data at the point of origin on tabulating cards which can then be fed directly into any data processing system without transcription or additional preparatory steps.

Circle item #1 on reply card

Improved Corona Control

A new grading device with improved corona control characteris-



tics for 345 kv transmission has been developed by the Lapp Insulator Co.

The design consists of two tubular aluminum sections in a novel

configuration that combines effective shielding with neat, functional appearance. The grading device attaches directly to the yoke assembly, shielding insulators, clamps, and conductors at the suspension end of the string. The design successfully controls corona at the 345 kv operating level, minimizing the RIV of the line.

Circle item #2 on reply card

Load Break Switch

A new type of load break switch (LBF-2) for fault closing in ratings 5, 7.2 and 14.4 kv is offered by the Westinghouse Electric Corp. At 5 and 14.4 kv, the fault closing ability is 60,000 and 40,000 amperes respectively.



The LBF-2 opens 600- or 1200 amp load current at 80 percent power factor and handles transformer magnetizing current in addition to small capacitive currents. At 600 amp the interrupting life at 5 kv is 500 operations. For the 14.4 kv at 600 amp, the interrupting life is 100 operations. At 1200 amp, the operating life is 20 interruptions before maintenance is required.

Circle item #3 on reply card

Hot Line Connector

Fargo Mfg. Company, Inc. is introducing a new line of massive hot line connectors. Known as the "HN Series," they have been de-



igned to meet the demand for a hot line connector with sufficient current carrying capacity for main line connections and the fault currents associated with these applications.

The massive "HN Series" features extra long contact areas, additional conductor encirclement, and a soft, pure aluminum spacer bar to minimize conductor "cold flow" and assure a low resistance connection. Other features include: one man installation combined with the secure attachment of the tap, large ears or lugs for a positive grip in all makes of hot sticks, and a broad hook to make the initial contact easily and remain in position without twisting during installation.

Circle item #4 on reply card

Distribution Transformer

A new, pole-type distribution transformer designed to achieve greater safety and economy in operation has been announced by Standard Transformer Co. It features cover-mounted HV bushings radially oriented from the pole with low voltage bushings located at the base of the transformer.



Standard reports the new design will effect savings in installation and services, and will offer improved appearance. The new units will be available in ratings from 10 kva through 167 kva. Standard will build in any of its three basic types—SW, an extremely low-loss unit; WA-65 which slightly exceeds industry standards; or CWA for systems where moderate overloads exist but transformer peak not coincident with system peak.

Circle item #5 on reply card

New Pistolmeter

Difficulties in measuring of current, voltages, resistance and testing circuits in inaccessible areas are



virtually eliminated, the company says, with the lightweight, one-hand-operable "Pistolmeter" introduced by Federal Pacific Electric Co.

Revolving jaws at the muzzle-end of the Pistolmeter permit their insertion into cramped gutters and cable boxes at any convenient angle and the trigger-operated probe light at the meter's end ensures safe, easy handling. A locking device on the meter pointer enables the user to make his reading after the Pistolmeter has been removed from the tested conductor.

Circle item #6 on reply card

Valve Arrester-Cutout

A new line of valve arrester-cutout combinations has recently been released by the James R. Kearney Corp. The new line features Kearney Unigap Valve Arresters in combination with Kearney GX, HX and Trip-O-Link Cutouts in 7.8 and 15 kv ratings. Arrester ratings include 3, 6, 9, 10, 12 and 15 kv.

Units are available on a choice of crossarm, pole or transformer mounting brackets, plus a T-bracket

Searching for Enclosures?



look to ...

SUPERIOR
SWITCHBOARD & DEVICES CO.

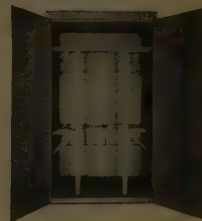
CANTON, OHIO

A Subsidiary of

The Union Metal Manufacturing Co.



Convert-A-Socket

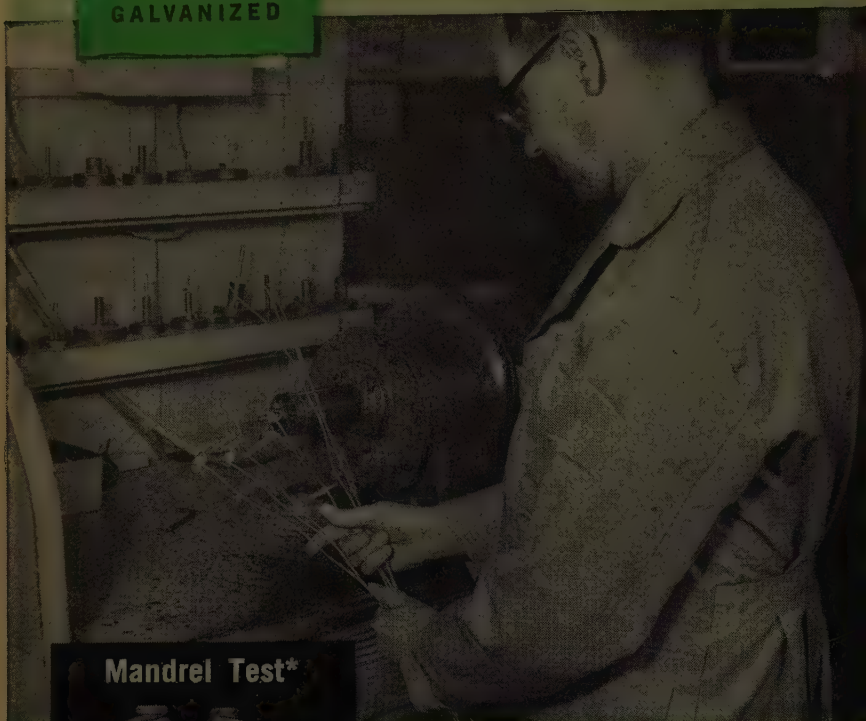


Meter Booth

Write for a free Catalog outlining types and sizes of enclosures, reactors, test switches, test blocks, and meter socket equipment.

Crapo
GALVANIZED

STEEL STRAND



Mandrel Test*



Checked and Double-Checked by Laboratory Technicians

Every coil of wire used in the manufacture of *Crapo* Galvanized Steel Strand is tested and approved by trained laboratory technicians. Samples from both ends of each individual coil are subjected to a series of prescribed tests before stranding. Then, the finished strand is re-checked to make certain that it conforms in every respect to established specifications and our own high quality standards.

Thus you know when you specify *Crapo* Galvanized Strand that every precaution has been taken to assure maximum performance in the finished product.

Write for Free Booklet

"The Story Behind *Crapo* Galvanized Wire and Strand" illustrating and describing manufacturing techniques and testing procedures. Ask for Booklet B-59!

AVAILABLE IN 3 COATING WEIGHTS

FOR GUYS, MESSENGER AND OVERHEAD-GROUND WIRE

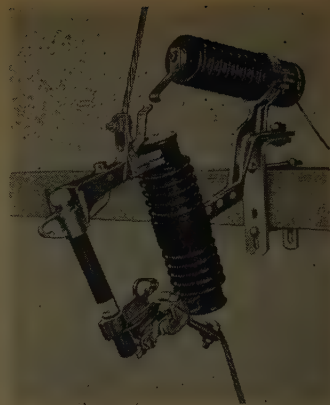
Crapo Steel Strand is available in all standard sizes and grades and in Class A, B and C galvanized coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.



*Determines ductility of wire and adherent quality of galvanizing.



STEEL & WIRE CO., INC.
Muncie, Indiana



for side-by-side mounting of arrester and cutout. All mounting brackets have been designed to allow the entire unit to be pivoted horizontally and positioned at any desired angle to the crossarm for maximum convenience.

Circle item #7 on reply card

Stringing Block

Sherman and Reilly, Inc. has introduced a new Flowing Arch Groove Conductor Stringing Block. Designed for large single conductors ordinarily requiring extremely large, heavy, conventional blocks, the unit allows a large effective sheave diameter without the extreme size and weight.

The flowing arch is made of seventeen individual segments which ride on two ball bearing rollers to form an arch which supports the conductor. The result is a 40 degree included sheave section, the maximum ordinarily required even under adverse conditions.



Circle item #8 on reply card

Three-Phase Power Center

A new line of three-phase power centers has been developed by the Pennsylvania Transformer Division, McGraw-Edison Co. The unit

re styled specifically for shopping centers, industrial plants, schools and similar applications in which appearance and space may be important factors. Designed for use with underground primary feeders, the new "Power Supply Centers" permit the elimination of fences and overhead structures without the expense of underground vaults. Sizes range from 750 through 2500 kva, 5 kv and below.

Standardization of features and accessories, according to Pennsylvania Transformer, has resulted in manufacturing economies that are reflected in prices now being quoted. In addition to low initial cost, long-range economies are predicted because of the elimination of normal maintenance costs for fences and overhead structures.



Circle item #9 on reply card

New Antenna Line

Motorola has announced a new line of folded coaxial design base station antennas for 136-174 mc two-way radio systems. Three antenna series are included—omni-directional (TAD 6070), cardioid (TAD 6080) and unidirectional (TAD 6090).

All three basic antennas, designed and manufactured by Motorola, utilize a center-fed half-wave design with a folded radiating element and a coaxial skirt section. This design eliminates projecting round plane rods to simplify installation, reduce pattering distortion and minimize ice damage in cold climates. Parasitic elements are used to provide specialized radiation patterns in the cardioid and unidirectional series.

Circle item #10 on reply card

EISLER TRANSFORMERS IMPULSE TESTED OIL FILLED • DRY TYPE • ASKAREL IMMERSSED SPECIAL AND STANDARD



EISLER TRANSFORMERS ARE DURABLE, ACCURATE AND DEPENDABLE . . . Made in sizes up to 3500 KVA.

EISLER RADIATOR TYPE TRANSFORMERS MADE TO YOUR SPECIFICATIONS



EISLER TRANSFORMER COMPANY, INC.

20 NORTH SALEM ST.
DOVER, NEW JERSEY



"Give me lock washers that will stay put!"

Specify **EATON-RELIANCE**
DOUBLE COIL Pole line Washers

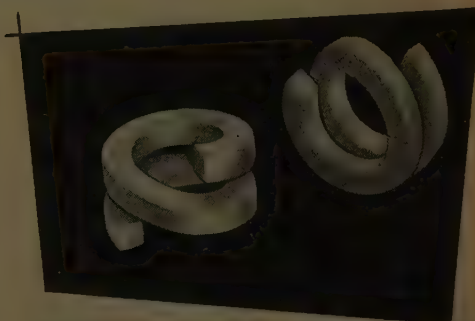
The Eaton-Reliance Thackeray Spring Washer was engineered specifically for pole-line usage where there is vibration and stress. Because of their greater reactive range, these **DOUBLE COIL HELICAL SPRING WASHERS** are specified daily by power line and communications engineers throughout the nation, and are paying off in reduced line maintenance costs because of longer washer life. Remember—the failure of a single spring washer could result in the failure of an entire transmission line. These rugged spring washers provide an extra margin of protection against failure. Write for specifications.

Reliance  Division

EATON

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Sales Offices in Principal Cities from Coast to Coast



MEN OF POWER



Lyons

Election of **T. D. Lyons**, comptroller of Allis-Chalmers Manufacturing Co., to the position of vice president, administration, Industries Group, has been announced by the company.

He brings to this newly created position a background of industrial engineering and accounting. In 1937, he joined Allis-Chalmers at its Boston Works where he served in the time study and works accounting departments. He came to the West Allis Works accounting department in 1942, and was appointed works accountant for the West Allis Works in 1946. He was named comptroller in 1954.

Succeeding Mr. Lyons as comp-

troller is **W. S. Pierson**, assistant comptroller since 1958.

A-C has also announced the appointment of **Will Mitchell, Jr.**, as director, Research Division. He has been the division's acting director since September, 1960.

* * *

Supervisor of machine accounting for the Kansas Power and Light Company, **Herman F. Schuster** was named assistant comptroller of the utility at a recent meeting of the board of directors. He does not replace anyone in this capacity, but will serve as an additional assistant comptroller for KPL.

He has been with the company 32 years, starting as a clerk in KPL's Salina office in 1929. In 1939 he was promoted to chief clerk of the company's gas and electric departments in Salina. He transferred to Topeka in 1946 as tabulating supervisor and

was named supervisor of machine accounting in 1957. Replacing Mr. Schuster as supervisor of machine accounting is **W. J. Raine**.

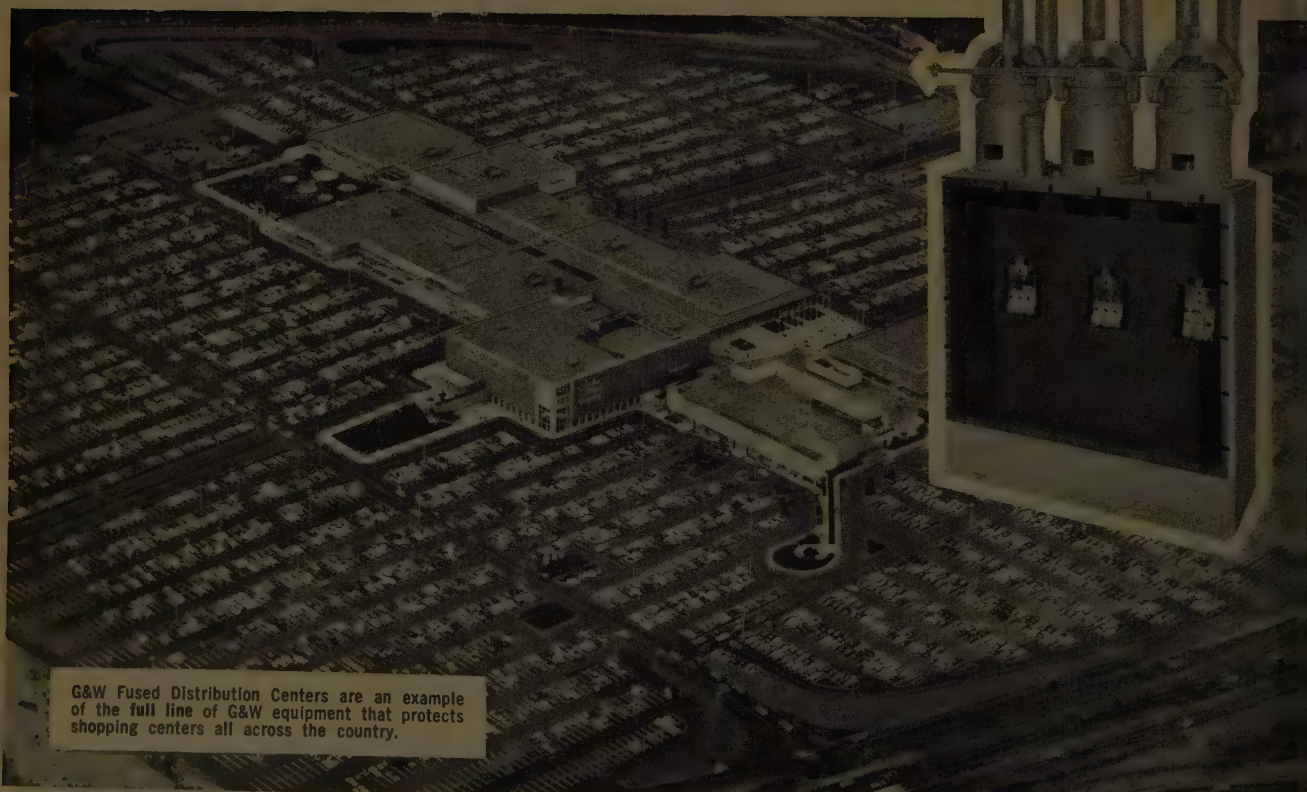
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Mississippi Power & Light Company has announced the following managerial changes: **F. G. Smith**, presently division manager at McComb, will transfer to the General Office to assume new responsibilities as assistant general sales manager. **C. P. Hester**, Northeastern division manager at Senatobia, will transfer to McComb as division manager of the Southern Division. **Joe H. Box**, now director of area development in the executive department, will transfer to Senatobia as NEN division manager. **J. S. Frame**, development engineer in the executive department, will assume the responsibilities of director of area development.

* * *

John F. Rich, currently chief executive officer of the New England Gas and Electric Association, and its subsidiary operating companies, has become president of the NEGEA Service Corp. He succeeds

Protect the MAIN LINE with

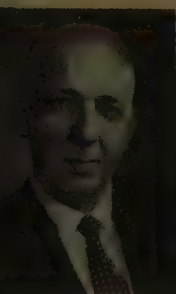


G&W Fused Distribution Centers are an example of the full line of G&W equipment that protects shopping centers all across the country.

all M. Henry who will continue to serve the company as a vice president, director and consultant.

Charles T. Abbott, a vice president of the NEGEA Service Corporation, has become executive vice president of the company.

* * *



Whitmore

Middle South Utilities, Inc. has announced the election of Paul G. Whitmore as a vice president. From 1929 until joining Middle South, Mr. Whitmore served as an engineer with Ebasco Services Incorporated.

In 1942 he was assigned to Middle South System subsidiaries with the responsibility of coordinating all system planning, construction, design, operating and similar engineering work between these companies and Ebasco. He has served as secretary of the Middle South System Operating Committee since 1945.

As a vice president of Middle South, Mr. Whitmore will represent

the company on matters concerned with System engineering and construction.

* * *

General Electric Company's Computer Department has announced the appointment of Robert S. Baker as manager of the Huntsville, Ala., Computer Center.

He was formerly manager of intermediate systems at the Computer Department headquarters. In his new position, he will be responsible for overall operations of the Computer Center.

In Schenectady, John L. Bauer has been appointed manager, Installation and Service Engineering-Study Projects in General Electric's Installation and Service Engineering Department.

Lawrence B. Miller, formerly manager, Machine Shop Operations, has been appointed manager, Manufacturing Administration and Plant Facilities for the General Electric Industry Control Department, Salem, Va.

G. E. has announced a new advertising and sales promotion staff for its Residential Market Develop-

Street Light Control

Shrugs off Killing Transient Voltages

How can a compact, lightweight photo control withstand the control-killing effect of a wide range of transient voltages?

Use Varistors to absorb surges which are below the spark-over of lightning arresters. Let the lightning arrester handle the higher transients.

That's the story on simple, reliable, surge tested LUMATROL MARK I*

Write for Bulletin 91a.

*Lumatrol Mark II, for 230 Volt circuits, is described in Bulletin 92.

LUMATROL MARK I



MICRO BALANCING, INC.
GARDEN CITY PARK, N. Y.

In Canada: J. R. KEARNEY CORP.
Box 270, Guelph, Ont.

& W Fused Distribution Centers

- * Ever had trouble with a branch 4-kv primary tap that blew the whole main feed?
- * Did you ever want to work on a tap and find you had to shut down the whole system before the tap could be isolated and safe to handle?

G & W Fused Primary Distribution Centers solve these problems completely by providing a fused, three-phase single-phase disconnecting device that can be operated under load for any tap off the main primary supply. Ideal for protecting primary loops or radial systems operating at voltages up to 15 kv, the G & W Centers can be used indoors or outdoors; are easy to install; and provide a disconnect for safety.

G & W Fused Distribution Centers have proved themselves time and again in applications at shopping plazas, industrial plants, and institutions with one or more loadings but these are only a few of the many places where they can be effective.

Distribution Centers are flexible. One or more circuits can be brought into a center to supply a fused load, or a single supply circuit can be used to feed a fused bus from which multiple load circuits are taken. The main primary feed can terminate in the box or run through as required. Insulated bus pads are provided for each phase leg with no limitation on the number of taps. The box can be bolted onto a concrete pad or embedded four to six inches into the concrete when the pad is poured.

Distribution Centers are gasketed to provide a weatherproof unit that fully meets NEMA Type 3 standards for weatherproof construction. Watertight, submersible construction is also available.



G & W ELECTRIC SPECIALTY COMPANY

3504 WEST 127TH STREET • BLUE ISLAND, ILLINOIS

Canadian Mfr. • Powerlite Devices, Ltd. • Toronto, Montreal & Vancouver

superior quality standards — inspired specialized design

ment Operation (RMDO). **Dabney Tunis** has been named manager-advertising and Sales Promotion (A&SP), and **Richard O. Parrish** has been selected as Specialist-A&SP.

* * *



Humphreys

Philip G. Humphreys, power production superintendent for California Oregon Power Company for nine years, and of the Copco division of Pacific Power & Light Company since merger into PP&L

in June, has been named superintendent of power production for the entire PP&L system in six states.

Mr. Humphreys, a veteran of 27 years with the utility industry in southern Oregon, already has assumed responsibility for PP&L's 40 hydroelectric and eight steam-electric generating plants. He succeeds **L. A. Morphe**y, veteran power chief for PP&L, who retires later this year.

* * *

Frank R. Harrington, Jr., has been promoted to the newly created position of director of general office services for the Toledo Edison Co. according to a recent announcement made by the company. In his new position he will be responsible for mailing, telephone, duplicating, and building services.

He was formerly rate and appraisal engineer and had been in the company's rate department since 1946. He began his utility career in 1930 at Eldorado, Kans.

* * *



Weiss

The appointment of **Dion Weiss** to chief electrical engineer for Jersey Central-New Jersey Power & Light Companies has been announced by the company. He was assistant chief engineer for the electric utilities,

and succeeds **Charles A. Dougherty** who retired recently.

Mr. Weiss joined JCP&L in 1936 as a cadet engineer at Morristown. He has served in various capacities

in the Engineering Department, including Relay Department superintendent at Allenhurst, and system distribution engineer at Asbury Park. In 1959 he transferred to the companies' Denville General Headquarters and to the new Morristown General Headquarters.

* * *

Philadelphia Electric recently announced several appointments in its electric transmission and distribution department. **R. S. Diggs** has been named assistant to the general superintendent. **W. L. Maruchi** has been appointed superintendent of the engineering division, and **S. J. Steinberg** becomes assistant superintendent.

In the Philadelphia service maintenance section, **R. F. Holman** has been named superintendent, and **M. G. Friderichs**, assistant superintendent. **J. R. Baumann** has been named assistant superintendent of the aerial lines section in Philadelphia.

All will maintain headquarters in Philadelphia.

MEN OF POWER BRIEFS

Former Director of Marketing for the Univac Division of Sperry Rand Corporation, **Edwin S. McCollister** has just been appointed Division vice president, Marketing, Electronic Data Processing, Radio Corporation of America. With headquarters in Cherry Hill, N. J., his responsibilities will include sales and supporting marketing functions in RCA's Data Processing activities.

The Standard Transformer Company recently announced the appointment of **R. A. Keeler** as district manager of its New York Office. He will be in charge of the New York, New Jersey and Connecticut areas.

William H. Schiek has been appointed manager of Sales Switchgear Division, Moloney Electric Company. He has been associated with the metal-clad switchgear field since 1936.

Appointed to succeed retiring **Stanley L. Walworth**, district manager for Ohio Brass Co. in western Pennsylvania, is **Kenneth Benson**, O-B's mining division representative in the territory for 10 years. Mr. Walworth will retire January 1.

Management—

(Continued from page 46)

almost weekly, the list of new interchange projects can be updated, as industry people well know.

"The electric companies are fully prepared to meet all the power needs of all the American people—now and in the years to come," concluded the report Mr. Oakes offered for the industry.

But, Mr. Oakes conceded, too, that "Federal agencies have already been authorized to build a few lines, and there are some others which we feel should be built . . . but we just don't know as of today, who will finally build them."

Regulatory—

(Continued from page 52)

"It is evident, therefore, that even if this Company's future return were, in accordance with our statement of policy, to be held to a rate of only 5.67 percent, the investment quality of its presently outstanding securities will probably not be maintained and its future credit questioned with the end result that the cost of future financing will be increased disproportionately to the giving the Company a fair and reasonable return."

"It is obvious from a careful reading of the Examiner's report that his conclusion as to the amount of additional electric revenue to which the Company is entitled is based upon speculation and conjecture, i.e., the supposition that the Company's operating income will show substantial improvement as the result of introducing Niagara Project power into its system. For example, the Examiner states that the additional revenue which he recommends ' . . . appears presently ample to meet known and anticipated requirements of the Company, at least until the benefits expected to be realized from utilization of the Niagara Project power becomes more pronounced.' However, nowhere in the report are the 'known and anticipated requirements' specified. In fact, such 'requirements' are not known and cannot be stated for the transition period under which the Company is operating. Nor is there anything in the record to support the assertion of 'the benefits expected to be realized from the utilization of the Niagara Project power.'

"In view of the terms of the contract between the Power Authority and Niagara Mohawk one cannot subscribe to the supposition that Niagara Mohawk will be enriched through the introduction of Niagara Project power into its system or that the Power Authority would even allow such an event to occur."

Commissioner Mylott quite properly concluded that, if and when such benefits are realized, there will be ample time for the Commissioner to make proper adjustments to the rates of Niagara Mohawk.



CALENDAR OF EVENTS

Oct. 15-20—AIEE Fall General Meeting, Statler-Hilton Hotel, Detroit, Michigan.

Oct. 15-20—National Safety Congress, Chicago, Ill.

Oct. 16-18—NELPA Business Development Section, Rate Research Committee and Public Relations & Advertising Committee Meetings, Davenport Hotel, Spokane, Wash.

Oct. 18-19—Wisconsin Utilities Association Fall Convention, Schroeder Hotel, Milwaukee, Wisc.

Oct. 18-20—Electric Council of New England 5th Annual Conference, Hotel Somerset, Boston, Mass.

Oct. 23-24—EEI Electrical Systems and Equipment Meeting, The Jack-Tar Hotel, San Francisco, Calif.

Oct. 24—Missouri Basin Inter-Agency Committee Meeting, Gordon's Holiday Spot, Minot, N. D.

Oct. 26-27—SEE Engineering & Operation Section Conference, Buena Vista Hotel, Biloxi, Miss.

Oct. 26-27—PCEA Hawaiian Conference, Princess Kaiulani Hotel, Honolulu, Hawaii.

Oct. 26-27—PEA Relay Committee Meeting, Penn Alto Hotel, Altoona, Pa.

Nov. 1—EEI Insurance Committee Meeting, Tides Hotel, St. Petersburg, Fla.

Nov. 1-2—PEA T&D Committee Meeting, Shenango Inn, Sharon, Pa.

Nov. 6-8—EEI Accident Prevention Committee Meeting, Tutwiler Hotel, Birmingham, Ala.

Nov. 7-9—Eighth Industrial Electric Exposition, Penn-Sheraton Hotel, Pittsburgh, Pa.

Nov. 9-11—PIP National Youth Conference on the Atom, The Palmer House, Chicago, Ill.

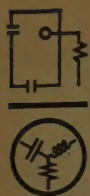


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ENGINEERING-OPERATIONS

First Pump Turbines To Operate At 1200-Ft Head . . .

Two single-stage reversible-pump turbines to be supplied by English Electric to the North of Scotland Hydro-Electric Board will operate at a 1200-ft head. To be installed at the Board's new 400-mw pumped-storage power plant at Cruachan in Argyllshire, the 142,000/136,500-hp units will pump water at night from an underground plant at Loch Awe to a reser-

voir 1200 ft above in readiness for daytime peak load.

The project claimed to be the world's first pumped-storage installation using single-runner reversible pump turbines to operate on daily cycles, was jointly developed by English Electric and Sulzer Brothers of Switzerland. The two firms also worked together on the Central Electricity Generating Board's plants at Ffestiniog in North Wales where installation of four 105,000-hp separate turbines and pumps is well advanced.

Ship-Augur Bit Is Driven With Square-Drive Wrench . . .

Louisiana Power & Light Company, with the cooperation of Snap-on Tools Corporation of Kenosha, Wisconsin, has made one of the lineman's most difficult jobs simple and easy—that of drilling holes in wood poles, timbers, and crossarms.

This has been done by adding a ½-in. square-drive socket head to a ship-auger wood bit and driving this bit with an ordinary ½-in. square-drive wrench, both electric and pneumatic. Development of this technique and the necessary bit, according to C. Clyde Crockett, LP&L's Transportation Superintendent,

began in the middle of 1958 when it was found that an impact wrench could do an excellent job of driving wood bits in drilling holes.

Walls Rise From Ashes . . .

Pulverized fuel ash—a waste product of power stations—has been used as a building material in two 14-floor apartment buildings nearing completion in London, England. The ash was made into hollow bricks for filling in the wall panels in the supporting reinforced structure. These ash blocks are light and fireproof and give good thermal insulation, but have to be protected from the weather on outside walls by an exterior layer of normal brickwork.

Prefab Bases Speed Street Light Installations . . .



Left, wooden forms are being removed from concrete footings to be used for street light standards.



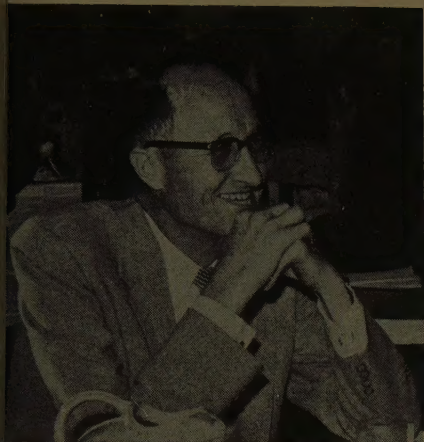
Right, mobile crane is used to move prefab bases from truck to prepared holes for the footings.

Niagara Mohawk's building and construction department has come up with another time and money-saving idea to get a job done quickly and efficiently. Last year they developed prefabricated footings for steel transmission towers—made in quantity at a station and transported to the job for quick and easy installation. The same idea was adapted recently to the installation of new street lights. The 790-pound, three-foot-high concrete bases were prefabricated at Huntley Station and carried to the job by truck.

There, a crane transferred the footings to prepared holes—lined and backfilled with limestone which eventually solidifies for permanency.

Previously a crew would take a day to make and set six or eight of these footings. Under the new system they are able to set twice as many and are not delayed by bad weather—an important factor in this type of work. Credit for developing the new system goes to Elmer Peacock and George Giarrappa of Buffalo.

LIGHT AND POWER LINES



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THE MAGAZINE OF ELECTRIC-UTILITY TECHNOLOGY

Playing Both Ends Against The Middle—On the one hand, we see an effort on the part of government-power advocates to build up an image of the non-existence of investor-owned electric-utility transmission interconnections. (A particularly brazen instance of this was cited in the July 15, 1961 "Light and Power Lines," which was headed "Only The Barest Beginnings?") This effort obviously is part of the pressure to bring about early government construction of regional interties as initial steps toward an eventual Federally-dominated Giant Grid.

On the other hand, the very fact that power companies are developing interregional transmission systems is being used as a basis for urging the government to jump into this kind of construction. Witness a statement made by Charles A. Robinson, Jr., staff engineer and counsel for the NRECA in making his request that Congress finance studies aimed at linking the Missouri River Basin with the southwest and northwest regions.

According to an article in *Tulsa World*, as carried in *FPC News Digest*, Mr. Robinson warned that "Unless the government does participate (in developing high-voltage interconnections), Southwest Power Administration will be surrounded with investor-linked lines through the heart of its territory."

The Giant Grid advocates would have us believe that their goal is a one-big-family type of transmission network, tying investor-owned and government power into the strongest, most dependable, most economical system possible—all for the greatest good of the consumer and of the over-all national interest. But history teaches otherwise: that the subsurface aim is nationalization or socialization of the power industry. And when this takes place, inevitably any consumer "savings" and any national-interest "benefits" are far more than offset by higher taxes to pay for the government projects, and by the drying up of tax revenue sources. Then there is the deeper evil of socialization: its destruction of the kind of private initiative and fundamental freedoms which underlie this country's greatness.

Those who are still propagandizing that expansion of government power is not expansion of socialism, took a jolting setback recently at the hands of none other than James M. Landis, President Kennedy's chief advisor on federal regulatory matters. Speaking to the American Bar Association, Dean Landis put it bluntly:

"In other nations where socialization has taken the place of private development, governmental operation has become the substitute for regulation. With us a certain degree of socialization has already taken place. We see it in the fields of public power, of nuclear development, of international finance, of space exploration. Whether we fear it or approve it, its growth is patent."

This should dispel much of the fog behind which the government-power proponents have been trying to hide the true political implications of their anti-free-enterprise schemes.

Publisher and Editor

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